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# WORLD PETROLEUM

NEW YORK AND LONDON

JANUARY 1937

BRAZILIAN MARKET UPSET BY TARIFFS

REFINERY CONSTRUCTION PLANS FOR 1937

FINANCIAL OUTLOOK IN ENGLAND AND THE UNITED STATES

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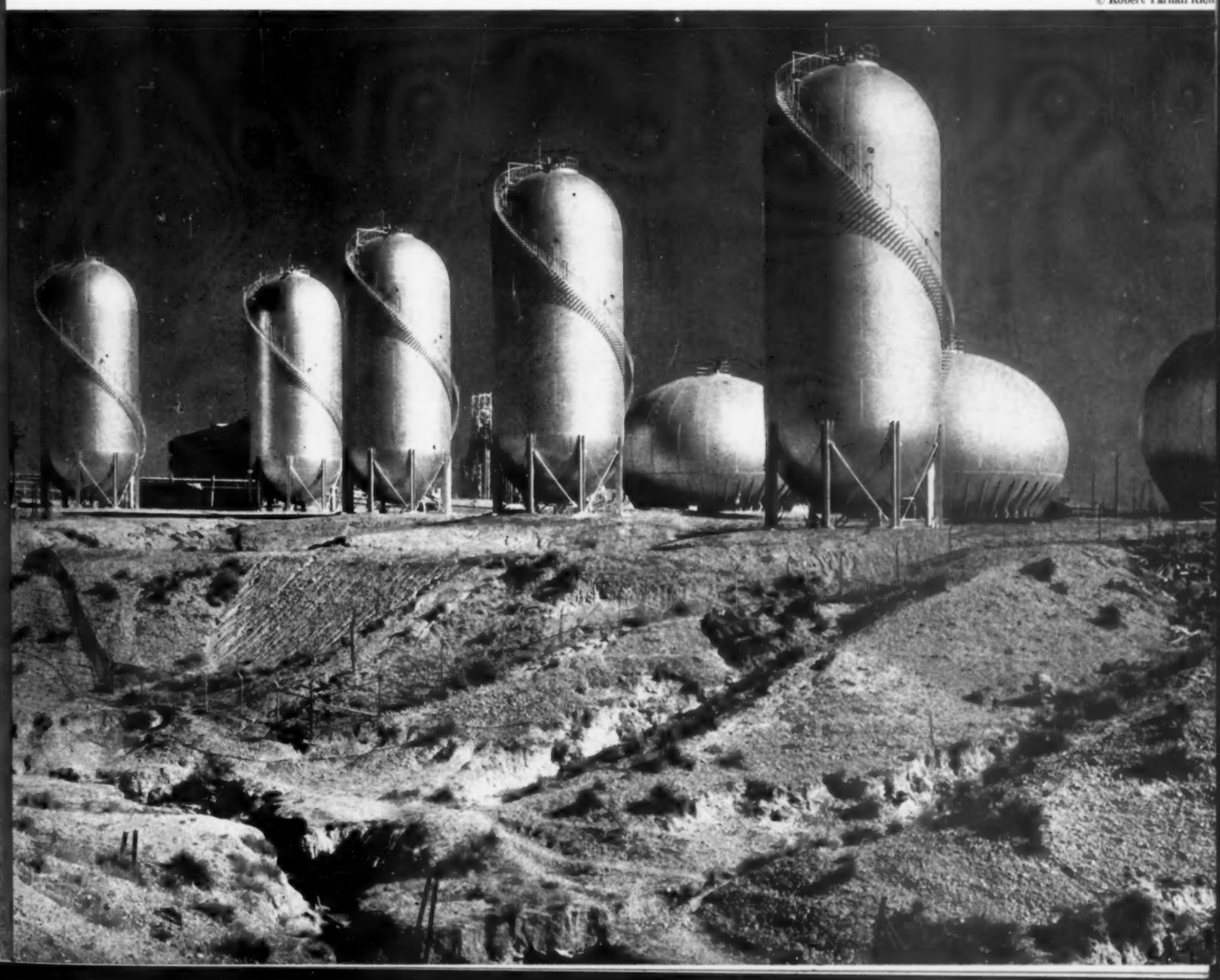

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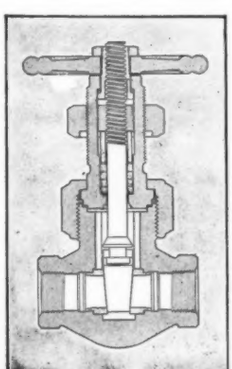

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*Above:* This Model C-55 is one of 6 International Trucks owned by the Schlumberger Well Surveying Corporation, California division, with headquarters in Long Beach. These trucks are subject to call 24 hours a day, every day in the year.

*At Right:* An International TA-40 TracTracTor, with rigid frame, on a pipe-laying project in Oklahoma.

*Below:* An International Model 300 Power Unit working for the Nemaha Oil Company in the Oklahoma City field.

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*Below:* The Shell Co. of Australia, Ltd., uses this International Truck for deliveries in Melbourne.

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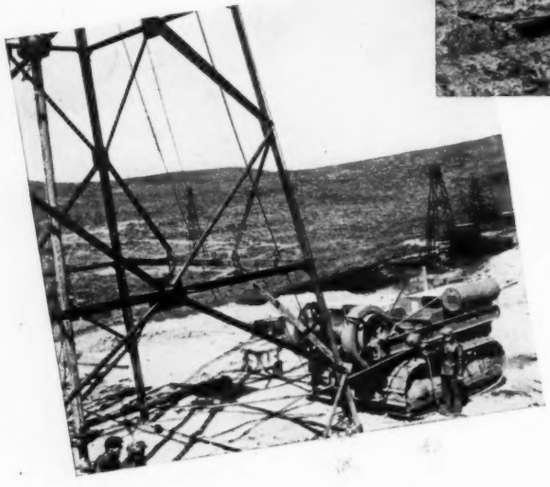

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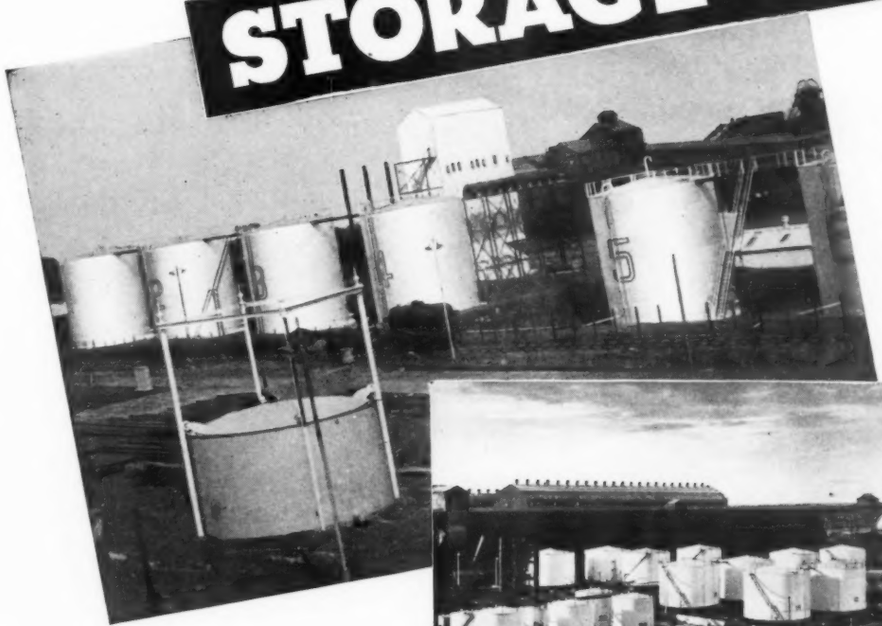

*Part of an installation of electrically welded mild steel storage tanks 27 ft. 6 in. diameter and 30 ft. deep, 17 in number, with a small welded gasholder in the foreground. Courtesy of Coal and Allied Industries Ltd.*

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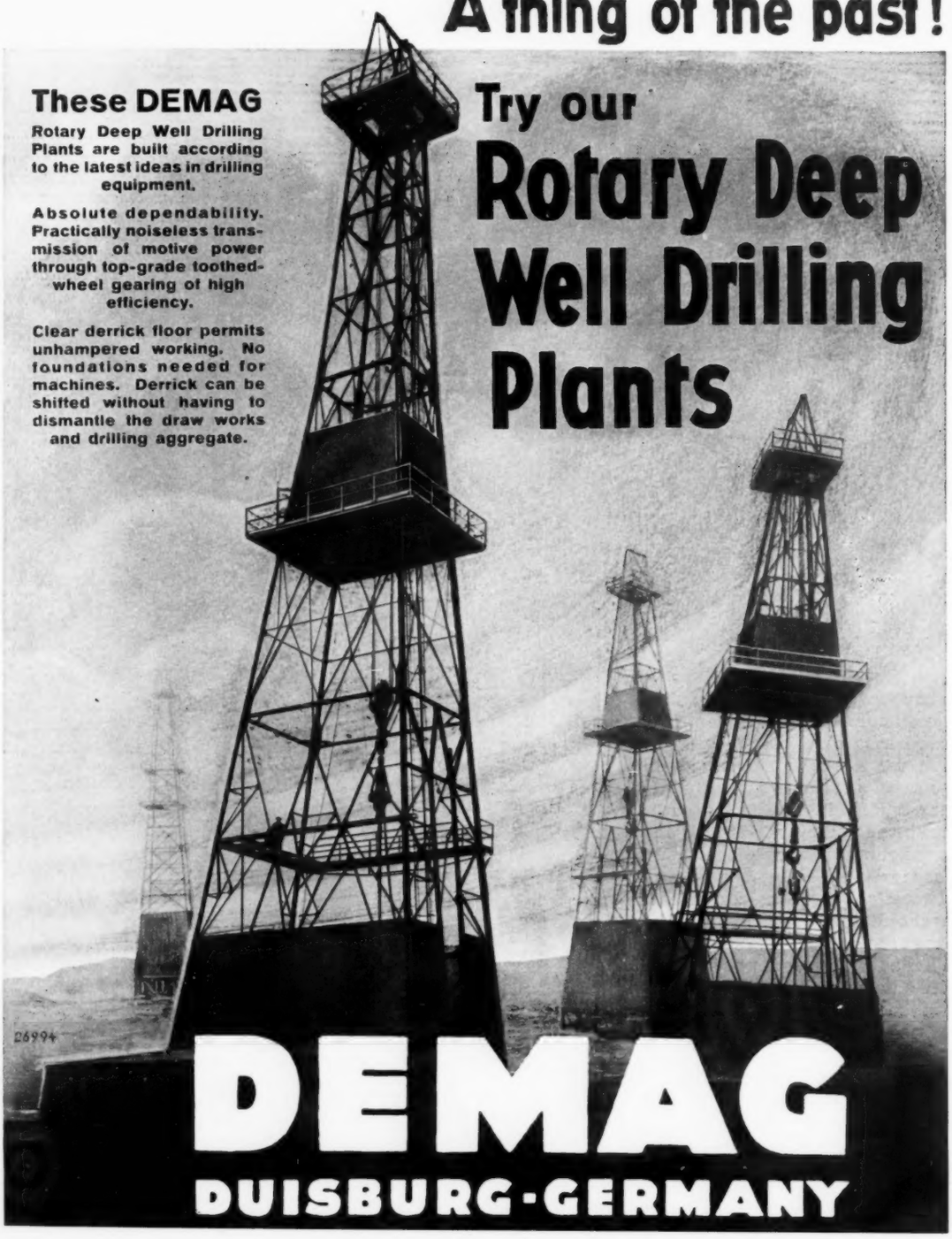
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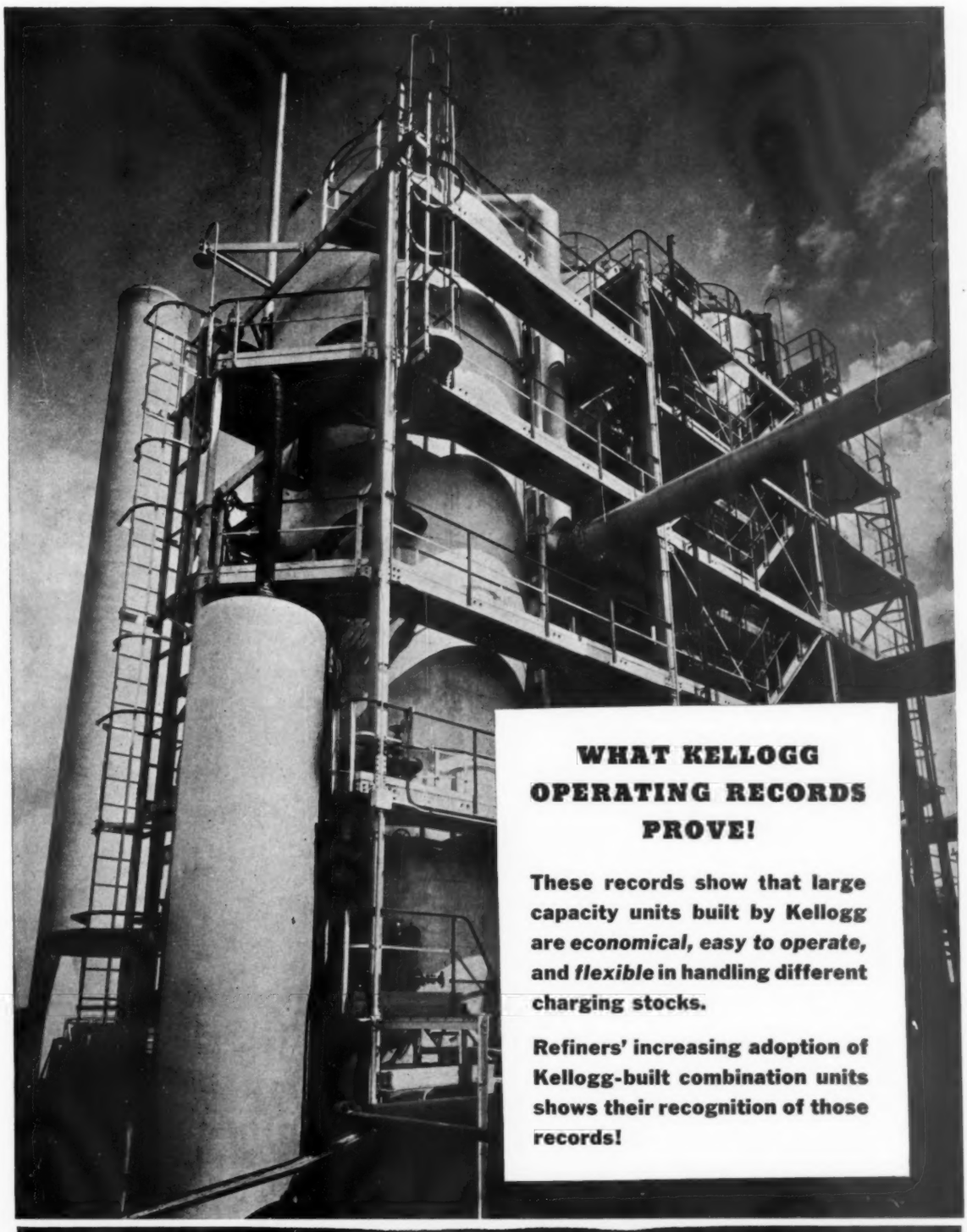
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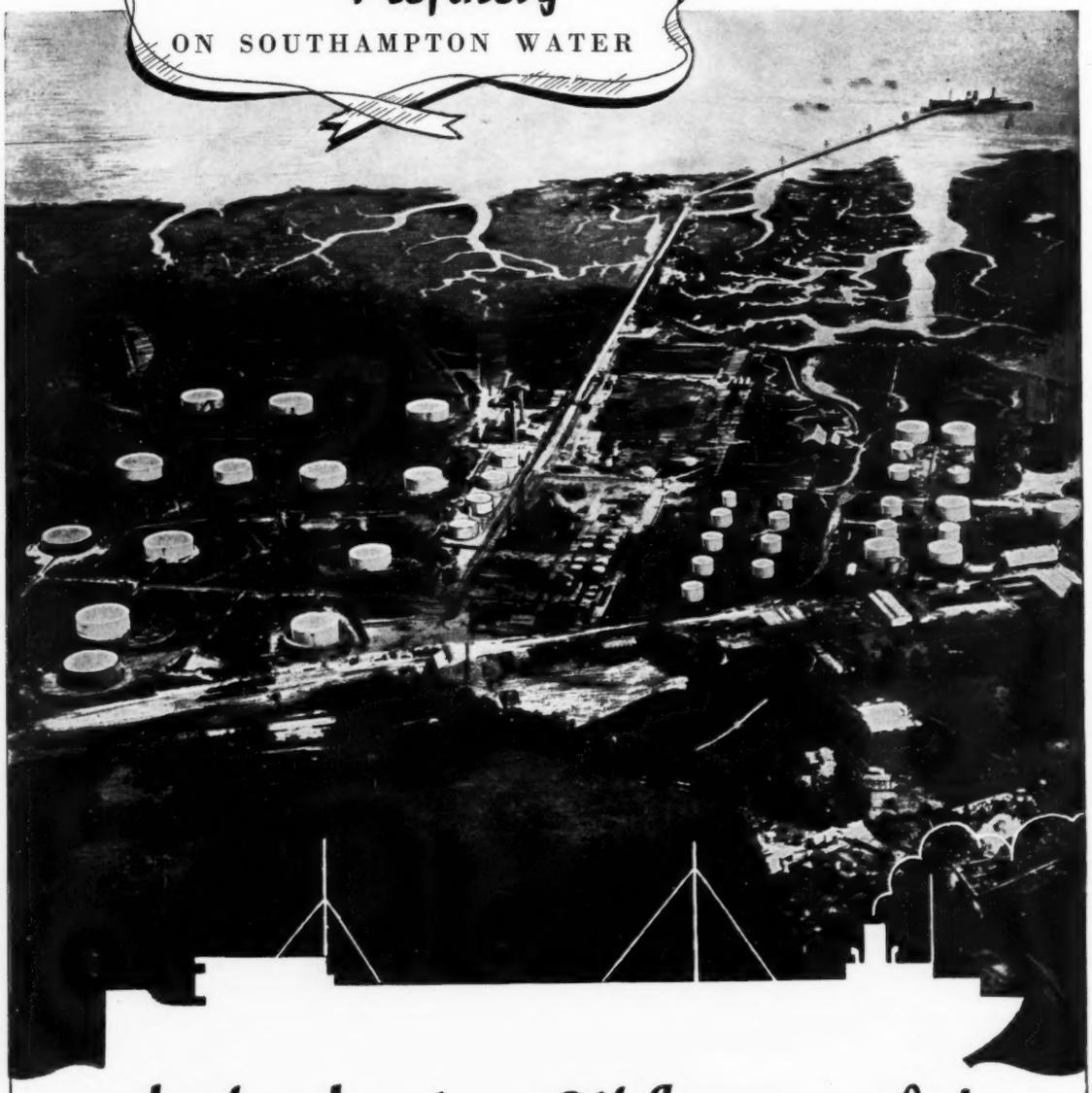

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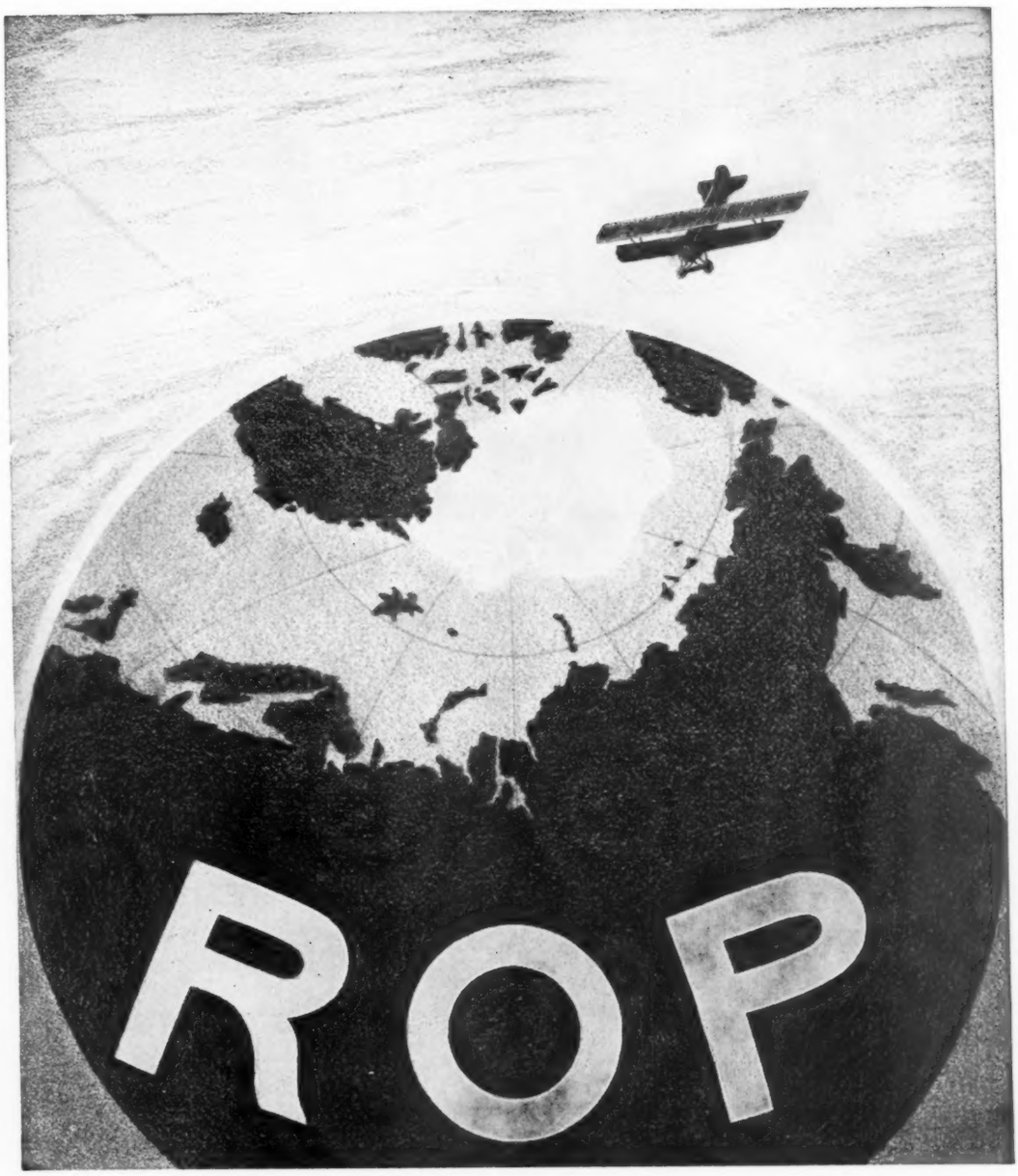


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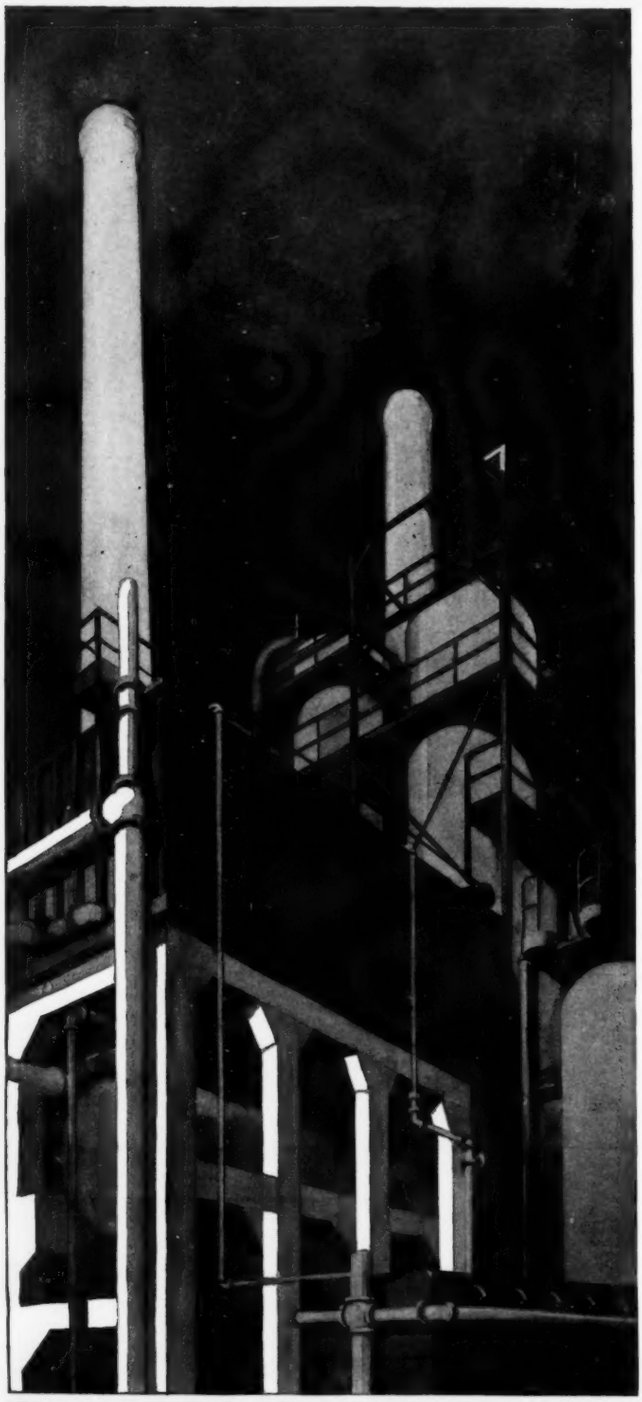

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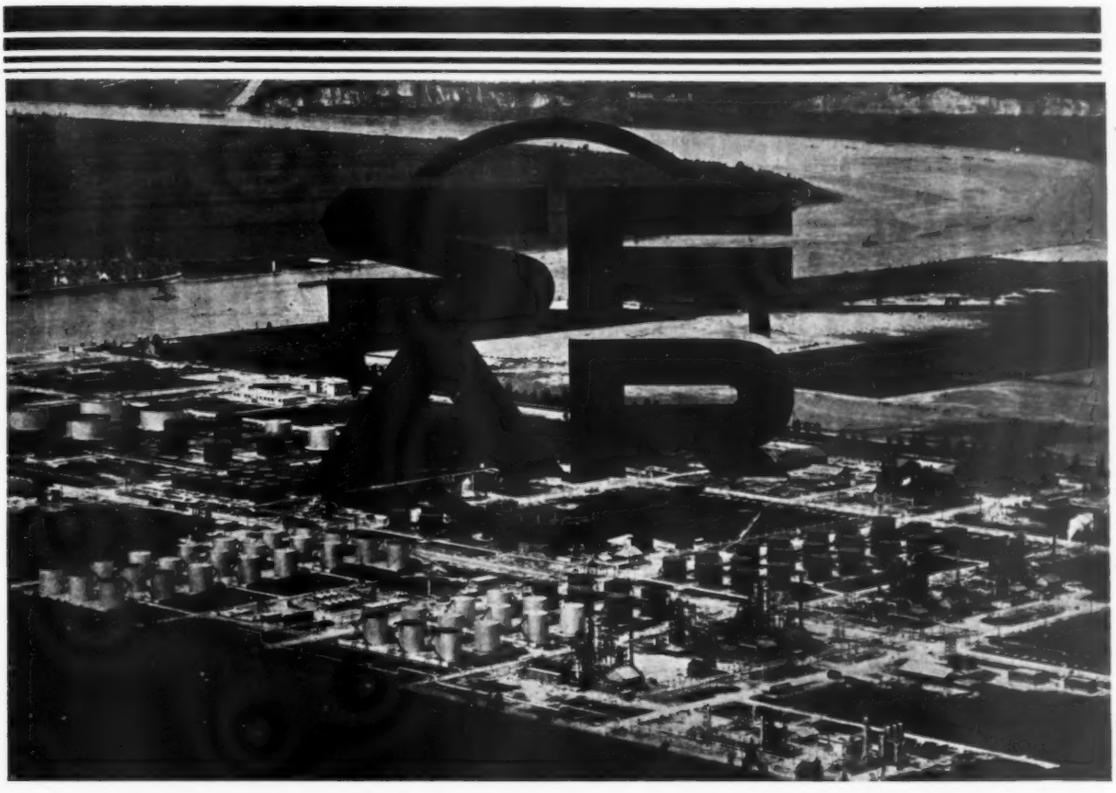

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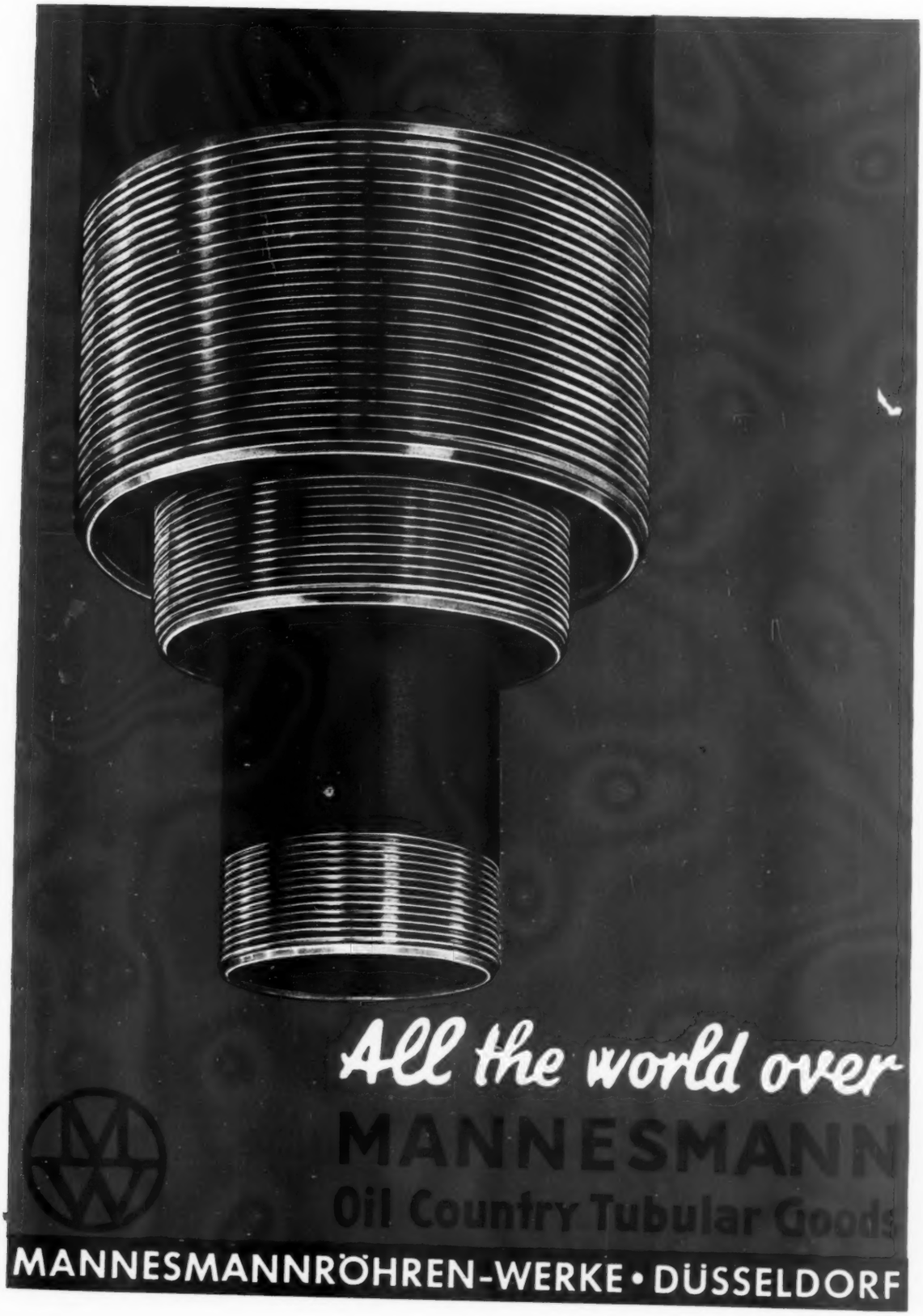
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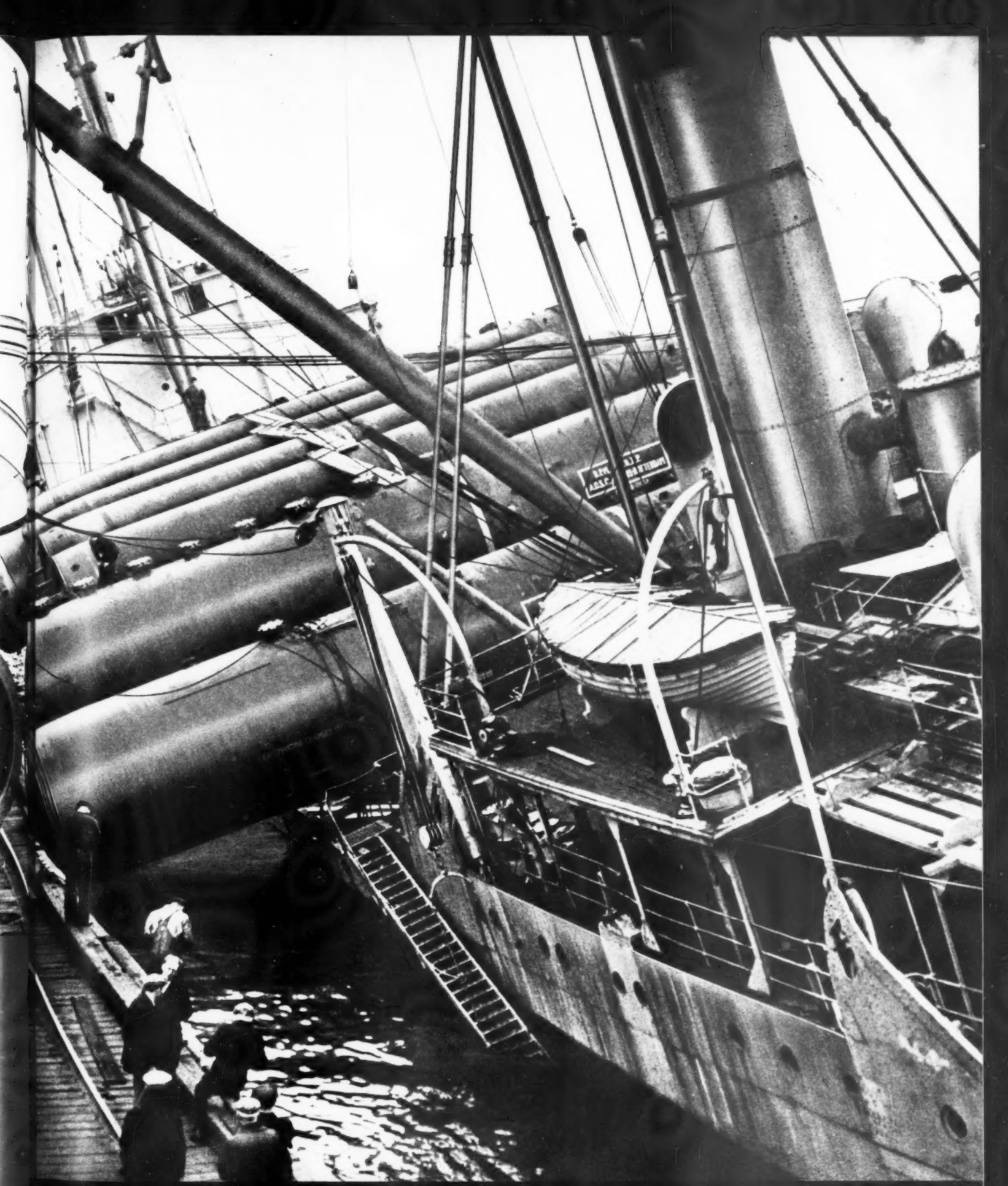

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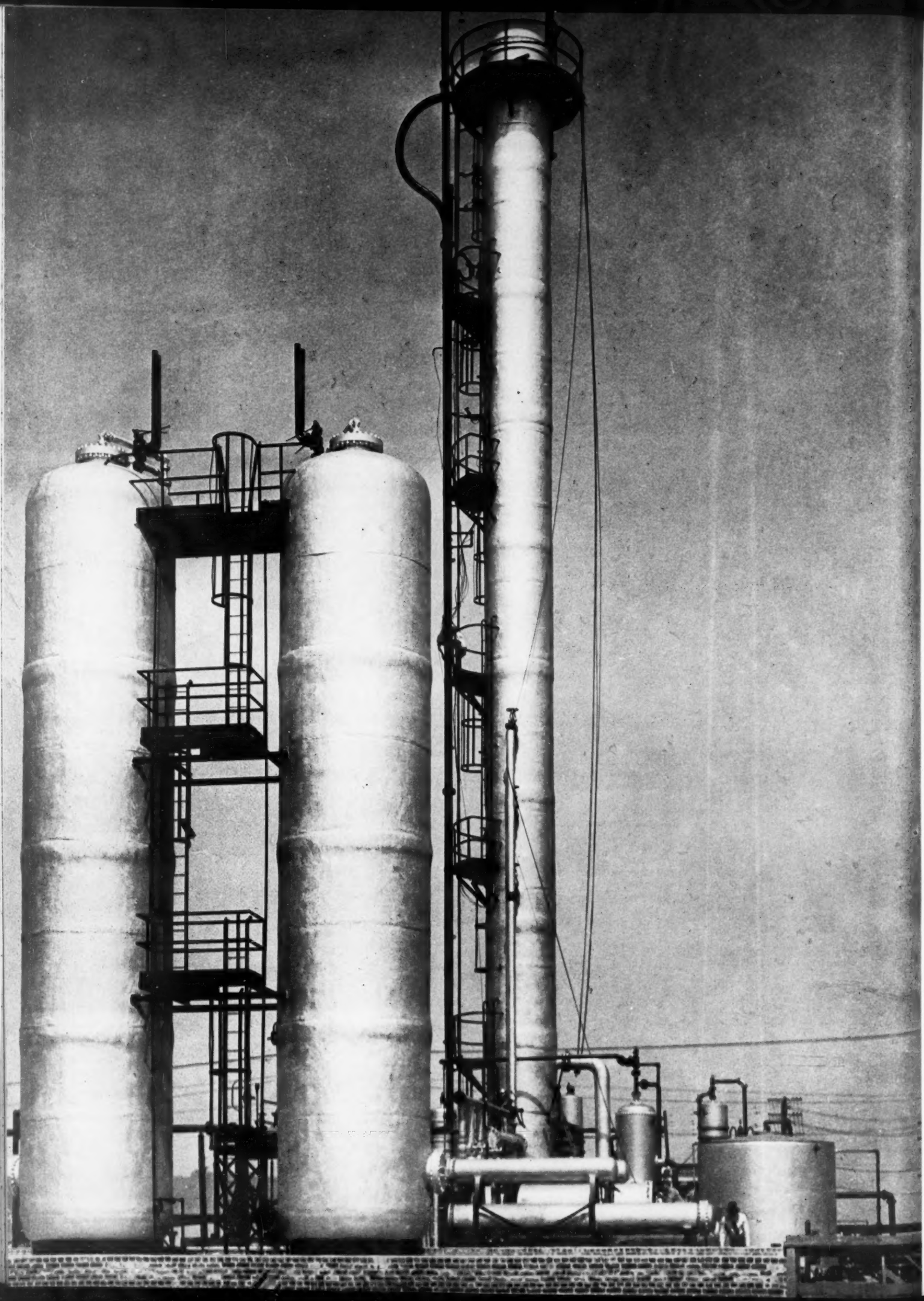


# WORLD PETROLEUM

NEW YORK AND LONDON

## MAKING NEW RECORDS

Year end comments by prominent members of the petroleum industry have emphasized the remarkable increase in demand during the past twelve months, the strong statistical position that has been attained, the greater market stability that has prevailed, and the improved financial showing of most oil companies.

The list of records established is a long one. Crude production, refinery throughput and demand for products, all were greater than in any previous year. In the United States alone motor fuel consumption exceeded 20,000,000,000 gallons and it is noteworthy that the oil companies received from these huge sales some $500,000,000 less than in 1929, the year of next highest demand. This is an achievement on which the industry may well pride itself. Another high record established in the United States was in the tax bill paid by the producers and consumers of petroleum products, which amounted to roundly $1,175,000,000 in 1936. This, together with approximately $1,000,000,000 expended for equipment and supplies and other tremendous sums disbursed for rents, royalties, wages and transportation shows the vital part which petroleum has come to play in the economy of the nation.

What is true of the industry in the United States is true equally of the world at large, with both production and consumption rising to new high levels. With world output at 1,780,000,000 bbl., or 4,900,000 bbl. daily, petroleum can safely lay claim to being a $10,000,000,000 business based on the extent of its annual contributions to other forms of industry.

## EXPLORATION INTENSIFIED

Since man is so constituted, however, that the future intrigues him far more than the past it is less interesting to linger over records already attained than to attempt a look ahead and endeavor to foresee some few of the developments likely to take place within the coming year. Certain of these are not difficult to deduce from what already has happened and from conditions that exist today.

One thing that can be predicted with entire confidence for 1937 is an intensification of the search for new supplies of oil. While there is no lack of reserves immediately available for this year and for years to come there is a practical certainty that total reserves are not being maintained, that new sources brought to light during the past year for example are not capable of replacing withdrawals during that same period.

This is a subject on which it is difficult to speak with complete exactness because it is impossible to know, down to the last barrel, either the capacity of new pools uncovered or the quantity remaining in fields under production. The estimate of men who are entitled to be considered experts, however, is that not more than 70 percent of withdrawals during the past year have been replaced by new discoveries.

The importance which the industry itself attaches to this matter is indicated by the race to acquire reserves, or to obtain control of lands that may possibly cover such reserves. It is revealed by the eager competition for concessions in the most remote and inaccessible parts of the world. The writer clearly recalls a conversation in which he took part a few years ago relating to the possibility of oil in Afghanistan and the scorn with which a prominent operator declared "It will be time to talk of Afghanistan fifty years from now." In the view of certain hard-headed business men the time to look into the possibilities of Afghanistan apparently is now.

The year now beginning will be characterized by a broad expansion in seismic surveying. Much has been learned during the past two years of this comparatively new tool for petroleum exploration. This knowledge has made it possible to apply geophysical methods in new and more effective ways. The impressive record of fields discovered and developed by such means has convinced those who at first were inclined to look askance at the new theories and their practitioners that geophysics has added tremendously to the accuracy of oil discovery.

Of course the drill remains the final test. In 1936 the number of wells drilled in the world was something over 30,000. Nearly 25,000 were drilled in the United States alone. Of these some 5,000 were dry holes. There has been much complaint of over-drilling in America but this refers, not to total borings but to the multiplication of wells in fields that are being adequately produced and where they are not needed. It is a safe estimate that more wells will be drilled the world over in 1937 than in any pre-

ceding year and that expenditures for equipment, materials and labor in this one line of activity will probably reach $700,000,000. A substantial part of this will go for exploration. With the advance that has been made in geophysical methods of survey there is hope that new fields of importance may be uncovered.

## GREATER DEMAND FOR PETROLEUM PRODUCTS

By all the criteria of business activity it seems certain that demand for petroleum products will increase materially in 1937. The rise may not be as great proportionately as the 10 percent plus shown in American consumption by 1936 in comparison with the preceding year. If the gain amounts only to seven percent it will mean the necessary addition of 210,000 bbl.—30,000 tons—to the daily output of the United States and 345,000 bbl.—nearly 50,000 tons—to that of the world at large. To handle this increase will require not only the provision of more equipment for production but the expansion of all forms of transport and storage equipment as well. To meet the growth in the world's requirements will necessitate an addition to supply greater than the entire annual output of any country, excepting only the United States, Soviet Union and Venezuela.

Demand for the various grades of fuel oil is expanding at such a rapid rate that it can no longer be rated as one of the minor products of the industry but takes its place alongside gasoline as a chief product. In 1936 the average daily demand for fuel oil in the United States was 1,123,000 bbl. or only slightly less than the gasoline consumption of 1,326,000 bbl. per day. This development raises some special problems which it will not be easy for the industry to solve.

At the present time there is a keen demand for oil and oil products in all parts of the world, leading to the payment of premiums on lots in favorable shipment positions. In part this activity may be due to existing international conditions but for this very reason it is as likely to increase as to abate as the year progresses.

## REFINERY CONSTRUCTION EXPANDING

In face of steadily mounting demand for petroleum products the world is deficient in cracking capacity—some parts of it more so than others. Plans already announced and under way indicate that the year will be one of record activity both in new construction and in the extension and modernization of existing plants. The movement toward the installation of combination units which was especially marked during the past year undoubtedly will continue during the coming season while special polymerization plants, solvent refining and dewaxing units and installations for the production of iso-octanes will respond to the increasing demand for these products.

It is noteworthy that refinery construction is no longer localized but is going forward in every part of the world. Expenditures in this branch of the industry will run to hundreds of millions during 1937 and will be exceeded only by the sums devoted to exploration and drilling.

## PETROLEUM, A CHEMICAL RAW MATERIAL

Crude petroleum as a raw material for the chemical industry will mark the next big step in utilization of petroleum and products.

During the past few years the attention of the industry has been concentrated on solvent refining, polymerization, the development of iso-octane motor fuels and the manufacture of extreme pressure lubricants. For some years past one of the largest United States chemical firms has been working on a plan for the utilization of waste gases from refinery operation for use in chemical plants.

In accordance with this plan, the next year or two is likely to see the construction of a number of chemical plants in the vicinity of important refinery centers. These plants will be supplied with gases that are produced as a by-product of cracking operations, and will form a major source of raw material for the production of synthetic chemicals of commercial importance.

Significant though these developments may be, they fit so inevitably into the pattern of modern refining created by the demand for ever increasing quality of motor fuels, as to have been anticipated for years by refinery technologists. What is new in the cooperation of the petroleum and chemical industries, is the use of crude petroleum as a chemical raw material.

Starting from the conception of crude petroleum as the cheapest and most plentiful organic chemical raw material, advanced refinery engineers in a very few instances have devoted research toward the development of a process by which crude petroleum may be treated to produce primarily synthetic chemical raw materials. This material, which in some cases was obtained from coal tar previously, furnishes benzol, toluol and xylol in unlimited quantities.

Coal tar production has been limited by the requirements of the steel industry, being produced as a by-product of steel manufacture. As a raw material it has been high in price compared with crude oil, and the cost of manufacture of products in the benzol, toluol and xylol range is far in excess of the cost of manufacture of the same range from crude petroleum. With the demand for these products far outstripping the ability of coal tar to supply adequate quantities of raw material, the work done in substituting crude petroleum as a raw material has been given new impetus.

Crude petroleum, as a raw material for the manufacture of ethyl alcohol in a pure anhydrous state, is also receiving more attention. A process for the manufacture of such alcohol may be put in commercial operation before very long. The significant fact is that alcohol requiring no further treatment to render it anhydrous can be produced at a considerably lower cost than alcohol made from grain.

# BRAZILIAN MARKET Upset by Tariffs

**Considerable Expansion of Crude Imports into Brazil Likely, Affecting U. S. Trade Balance and Brazilian Government's Revenue. Refinery Construction Likely to Result From Tariff Policy.**

AN UNUSUAL and unsettling condition is developing in the Brazilian market for petroleum products through the increase in small local refineries. The exceptional feature in the situation is that the establishment of these plants is not in response to economic necessity. The country has no domestic crude production with which to supply refining plants nor is there need of such facilities to serve the Brazilian market which is amply supplied by the large international companies through services which they have built up over a long period of years.

Explanation of the growth of domestic refining in Brazil is to be found in the structure of the tariff applying to petroleum and its products which places only nominal duties on crude and fuel oil as compared to the much higher rates applying to kerosene and motor fuel. Crude oil entering Brazil, for example, is taxed at a rate equivalent to about one-fifth of a cent, U. S. currency, per gallon. The duty on Diesel oil is equal to about three-fourths cent U. S. per gallon. On the other hand kerosene imports are assessed approximately five cents per gallon and motor fuel about eight cents per gallon.

As a result of this spread between rates it has been found profitable to import Diesel oil and by a process of simple distillation convert it into kerosene. The final product of these crude plants is inferior to that manufactured in the up-to-date refineries of the larger companies but the margin of 4.25 cents a gallon provided by the difference in tariff rates leaves a satisfactory profit to the local operator even though he sells a little below the established basis.

While the movement toward the construction of these distilleries began only a little more than two years ago some twenty-five such plants were in operation in 1936. For the most part they are located in and about the cities of Rio de Janeiro and Sao Paulo which are the main consuming centres of the country.

Due no doubt to the financial success attained with a relatively small investment by these local distillation plants various groups and individuals decided that there would be a lucrative business in constructing complete refineries to operate on crude oil imported under the extremely low duty of less than 8.5. U. S. cents per bbl. In 1935 the first refinery capable of producing a full line of products was erected at Uruguayanna in the state of Rio Grande do Sul in the extreme southern part of Brazil.

This refinery has a capacity of only about 200 bbl. per day. The enterprise has had a rather checkered course and has operated somewhat irregularly. Several times it has had to suspend operations entirely because of lack of crude oil. Nevertheless the prospects of profit in this field are sufficient to attract others and in August 1936 a new company—"Ipiranga" Sociedada Anonyma Companhia Brasileira de Petroleo, more briefly referred to as Ipiranga S.A.—was registered at Rio Grande for the purpose of constructing a petroleum refinery and importing, exporting and distributing primary materials and finished products. The company in fact is authorized to engage in all branches of petroleum trade. One of the objectives mentioned by its charter is the discovery and exploitation of petroleum deposits within the country. How definite this purpose may be is uncertain but it is well understood that the immediate intention is to build a refinery to run on imported crude.

The initial capital of "Ipiranga" S.A. is fixed at 18,000,000 milreis or slightly over $1,000,000 U. S. at current exchange. The capital is divided into shares of 5,000 milreis or about $275. Some of the financial interests back of the refinery at Uruguayanna are understood to be connected with the Ipiranga project. Representatives of the company assert that arrangements have been made for an assured supply of crude from the west coast of South America.

Some months ago one of the groups engaged in the distillation of kerosene from Diesel oil in the Sao Paulo district decided to take advantage of the greater duty saving that could be realized by running imported crude and a trial shipment was brought into Santos for this purpose. After some delay the customs authorities decided that it was entitled to admission at the rate of approximately one-fifth of a cent (U. S. currency) per gallon previously referred to. This has encouraged other groups to follow a similar course and a considerable expansion in crude imports is in prospect unless the government can find some way of equalizing the present unbalanced tax rates applying to different classes of products.

The rate at which this business is developing is indicated by the following figures:

| | Year 1935 | | First 9 months of 1936 | |
|---|---|---|---|---|
| | Sales expressed in bbl. 50's | Percentage of total consumption | Sales expressed in bbl. 50's | Percentage of total Consumption |
| Kerosene | 19,271 | 3.46 | 23,500 | 4.99 |
| Gasoline | 3,400 | .17 | 9,270 | .56 |

Imports of principal petroleum products into Brazil are shown by countries of origin for representative years of the past decade in the accompanying table on page 26.

It will be observed that during the past few years there has been a decided falling off in the imports into Brazil of fuel oil and kerosene from the United States. It is noteworthy too that 1935 is the first year in which Brazilian imports of crude have become of statistical importance. Receipts in that year represented crude from Argentina supplied to the refinery at Uruguayanna. Down to the present time shipments of gasoline from the United States have been fairly well maintained but if the movement toward domestic refining continues to increase in Brazil a decided falling off in the gasoline trade between the two countries is to be anticipated. This will be a serious matter for the United States. Because of heavy purchases of Brazilian products its imports regularly are greatly in excess of exports giving it an unfavorable trade balance on exchange between the two countries. Of exports from the United States to Brazil petroleum products long have formed a most important item. In 1926 the United States supplied 77 percent of Brazilian imports of petroleum products while in 1935 it provided only 55 percent. The drop in money value in this trade had been nearly $10,000,000. If importations of crude oil displace those of petroleum products to an increasing extent the position of the United States as a buyer from Brazil will be rendered more difficult and unsatisfactory.

To the Brazilian government the substitution of crude imports for finished products contains embarrassing possibilities of loss of revenue with no adequately compensating advantages. While those who are responsible for this shift in operations place some emphasis upon the claim that they are building up a new national industry the fact is of course that the number of persons who can be given employment in the operation of a

petroleum refinery is relatively small. On the other hand the loss to the government in revenue is real and important and may rise to as much as $10,000,000 yearly. In addition to this is the loss of revenue to the states which may reach $4,000,000.

The natural inquiry that presents itself at this point is why the federal government, if it desires to avoid a loss of revenue, does not equalize the taxation of different classes of products by raising the import duty on crude and Diesel oil. The difficulty in the way of this solution is the clause in the Brazilian Constitution which provides that import duties on any product shall not be increased more than 20 percent per year. Apparently the only way in which the government can halt the movement toward multiplication of local refineries and preserve its revenues is by establishing an internal tax on refining operations. In the case of the individual states where the output of local refineries has been favored by exemption from the consumption tax on motor fuel it is doubtful whether refiners could be compelled to pay a tax of this kind which is not intended to apply to raw materials.

It does not appear that the nominal import duty on crude oil as compared with the substantial tax on kerosene and gasoline was adopted with the deliberate purpose of building up a domestic refining industry. In fact the only explanation of this discrepancy obtainable is that at the time the tariff law was drawn there were no refineries in Brazil and no imports of crude and that it did not seem likely that refineries would be established unless or until domestic production of crude attained commercial importance. The oversight in drafting the law, if such it was, threatens to cost the nation dearly unless some means of remedying it can be found that are not in conflict with the Constitution.

Brazil's situation is not like that of certain countries which have encouraged the building of domestic refineries to handle their large crude output. Whether or not petroleum deposits of commercial size exist in Brazil is still an unanswered question. Until local crude oil production in marketable quantities, and that can be produced and transported to the consuming centres at reasonable cost, is a known and proved fact, it will remain uneconomic to build up a refining industry within the country. Moreover the expanse of Brazil is greater than that of the United States and if crude oil were discovered in the upper Amazon or at other points far distant from the consuming centres, it might still be less economic as a supply to the country's needs than importations.

Nor is the argument of greater security in time of war one that can be seriously advanced to support the upbuilding of a domestic refining industry in Brazil. Even in the case of European nations it has been shown that this argument has little force. On the contrary the present view is that a country which can draw finished products from any part of the world where they happen to be available is in a better position than one that has given hostages to fortune in the shape of extensive refining plants which are outstanding marks for aerial attack. In the western hemisphere, moreover, the sentiment of governments and peoples is so strongly against war that arguments based upon its occurrence are of remote application.

To the long established oil companies operating in Brazil which have invested large sums in far-reaching systems of storage and distribution and which maintain efficient marketing facilities in all parts of the country, the prospect of seeing the most profitable parts of their market taken away by concerns whose competition is made possible only by discriminatory tariff rates, naturally is most unwelcome. They could to be sure take advantage of this condition by building refineries of their own within the country. This, however, would represent an economically unsound duplication of existing refining facilities which have been constructed at points advantageously situated in relation both to sources of supply and to consuming markets.

Brazilian consumers of petroleum products who have studied the existing situation feel that they, most of all, are certain to lose by the continued maintenance of present conditions. If crude oil gradually replaces imports of finished products they are the ones who will have to make good the government's loss of revenue, either through general or special taxes. At the same time they may be forced to accept inferior products in place of those of world-wide reputation and established high quality that they now obtain. Not only will this be true of the individual but industries which depend upon petroleum products for their operations will be hampered in their development and impaired in their ability to compete.

## Imports of Petroleum and Products Into Brazil

### Gasoline

| | 1936 Kilos | 1930 Kilos | 1934 Kilos | 1935 Kilos |
|---|---|---|---|---|
| United States | 120,704,059 | 128,215,726 | 115,950,964 | 129,221,200 |
| Mexico | 30,907,459 | 59,044,748 | 43,369,348 | 28,426,840 |
| Peru | — | 72,337,672 | 82,132,194 | 67,264,931 |
| Dutch West Indies | — | — | — | 50,435,339 |
| Others | 940,050 | 19,897,000 | 23,213,142 | 980,171 |
| TOTAL | 152,551,568 | 279,495,146 | 264,665,648 | 276,328,481 |

### Kerosene

| | | | | |
|---|---|---|---|---|
| United States | 78,679,596 | 65,465,619 | 70,350,495 | 67,524,093 |
| Mexico | 11,919,014 | 19,053,244 | 15,181,609 | 16,587,792 |
| Peru | — | 4,322,974 | 7,578,365 | 8,120,001 |
| Others | 1,422,441 | 1,624,137 | 258,164 | 1,656,840 |
| TOTAL | 91,021,051 | 90,465,355 | 93,368,633 | 93,888,726 |

### Lubricating Oils

| | | | | |
|---|---|---|---|---|
| United States | 28,444,743 | 21,727,044 | 28,023,153 | 30,889,197 |
| Great Britain | 928,635 | 1,107,516 | 1,179,175 | 1,155,514 |
| Mexico | 8,998,711 | 1,449,738 | 2,051,079 | 2,429,253 |
| Others | 287,345 | 286,979 | 50,684 | 76,458 |
| TOTAL | 38,649,434 | 24,561,277 | 31,304,091 | 34,550,427 |

### Fuel Oil

| | | | | |
|---|---|---|---|---|
| United States | 72,751,678 | 35,027,576 | 2,319,587 | 12,079,974 |
| Mexico | 96,989,682 | 2,414,340 | 115,225,256 | 125,976,392 |
| Venezuela | 46,709,607 | 19,324,520 | — | — |
| Dutch West Indies | — | — | 326,549,623 | 290,114,351 |
| Others | 1,147,578 | 317,690,141 | 7,865,715 | 8,549,779 |
| TOTAL | 217,598,545 | 374,456,577 | 451,960,181 | 436,712,496 |

### Crude Petroleum

| | |
|---|---|
| Argentina | 2,376,190 |

## Shell Company in Colombia

The Hon. Francis John Hopwood and Wilhelm Vest have organized the "Compañía de Petróleo Shell de Colombia" to engage in all activities of the petroleum industry. The Company is organized with a $3,000,000 capital (pesos) divided in 3,000 shares of nominal value of $1,000 pesos each. The Board of Directors are: Andrew Agnew, C. B. F.; Wilhelm Vest; Frederic Godber; Dr. Rubén Jaramillo Arango; The Hon. Francis John Hopwood; Dr. Daniel Trumpy; Fiscal Manager Dr. Eduardo Vallejo and alternate Walter Joseph Bruton.

*Crude storage tanks at a modern British refinery.*

# ADVANCE PLANS

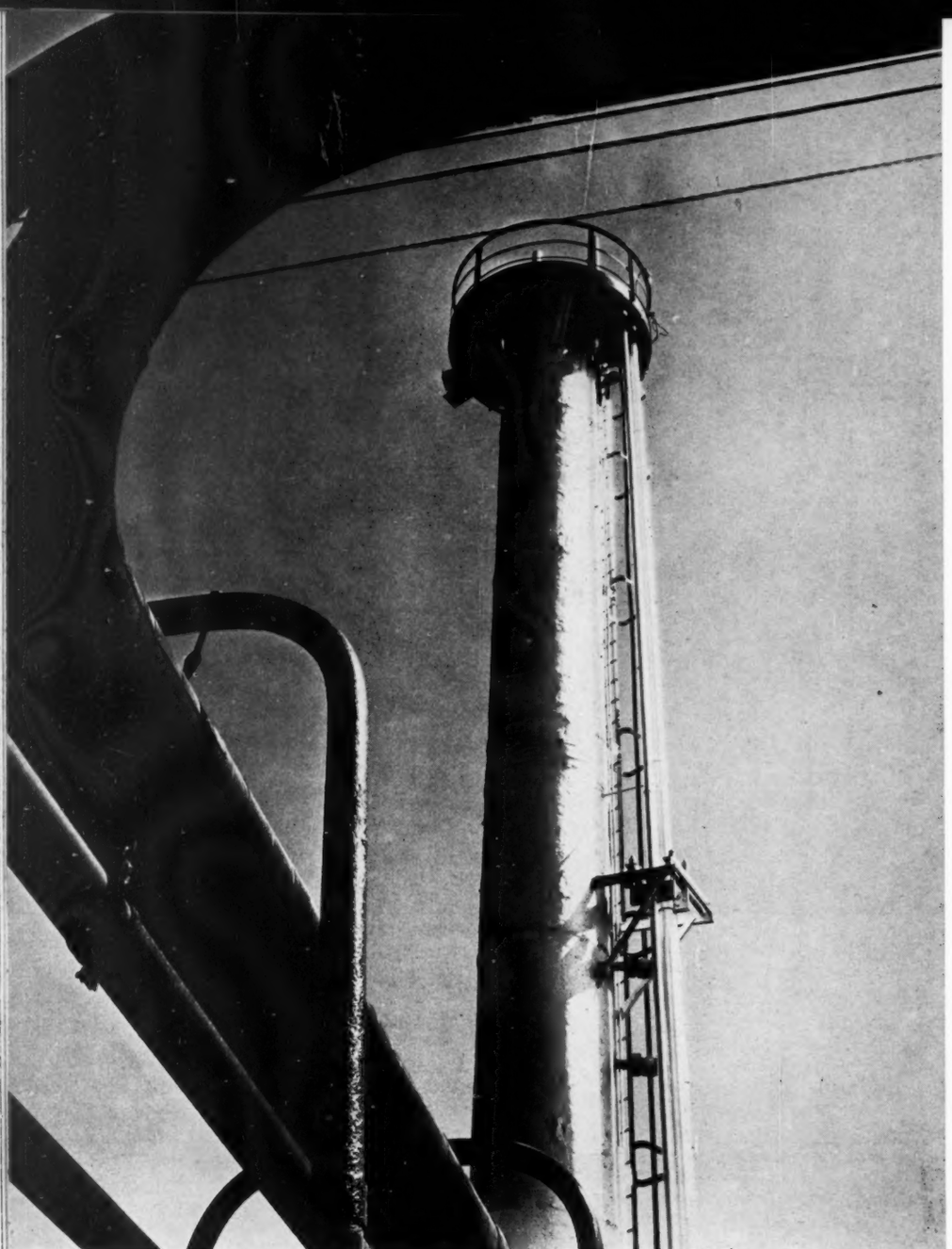
## Call for Extensive Refinery Construction

**In the next 18 months many new refineries will be constructed and existing plants will be modernized: the following article deals with unannounced plans and, in some cases, unconfirmed rumors concerning some of the planned construction.**

INCREASED refinery construction will be a feature of the immediate future. The following brief survey of construction and enlargement plans is by no means complete but it does give a definite indication of how extensive are the industry's plans for increasing refinery capacity. Some of the plants described below are actually under construction, on others contracts have been let, while still others are entirely in the planning stage —the plans may be extensively revised, postponed or even abandoned. The possibility of the initiation of some of the most interesting construction jobs referred to in this article is suggested as a result of trends that have been developing over the past several years rather than from any definite information or plans of a specific company.

The design and construction of plants to use crude petroleum as a raw material for the production of synthetic chemicals belongs in this category. While no definite plans are now known, it is apparent that cooperation between the petroleum and chemical industries has proceeded to such a point that such plants will soon be transferred from the drawing board to steel and concrete reality. Already some work has been done in the utilization of by-products or waste from cracking operations to produce synthetic resins and plastics. More work will be done in the immediate future, such as locating chemical plants adjacent to refining centers, where these plants can operate on refinery waste gases to produce chemical compounds for which there is a growing demand.

But of even greater importance is the likelihood that plants will be constructed that will process crude petroleum to produce raw materials hitherto derived from other sources for the use of the chemical industry. The inevitability of this step can readily be seen when it is considered that crude petroleum furnishes a complex organic chemical



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*Stabilizer at the Lawrenceville, Texas, plant of the Indian Refining Co. (The Texas Company).*

raw material at a cost of less than half of what is now the least expensive chemical raw material. Thus we may well see within the next year or two the construction of plants in the United States and possibly abroad which will treat crude petroleum to produce high percentages of aromatics in the benzol, toluol, xylol and naphthalene range, materials that are finding wider and wider use in the manufacture of fast drying paint and other products.

The demand for such materials is increasing rapidly, while the present source of supply might almost be said to be stable—these products having in the past been produced from coal tar, production of which occurs as a by-product in the manufacture of steel. It has already been indicated that aromatics in this range can be manufactured from crude petroleum at a considerable saving over production from coal tar. Taking into consideration that the supply of coal tar is limited, it will soon be necessary to turn to petroleum as a raw material for their manufacture. If design of a process for commercial production of this range from crude petroleum had already been completed no doubt some plants of this type would be started within the next few months.

It is generally felt that 1937 will see even more refinery construction and modernization initiated than has been undertaken for many years past. Despite the building activity that marked the refinery branch of the industry all through the depression, construction and modernization did not keep pace with obsolescence. It is now essential that plants be brought up to maximum efficiency and new capacity constructed to meet the rapidly expanding demand for petroleum products. For the first time in several years the oil companies can feel confident that the money is readily available for this important work. It appears likely that something like $60,000,000 will be spent on reconstruction, modernization of existing plants and construction of new capacity in the United States during 1937. Nor is refinery construction activity going to be confined to the United States. Elaborate plans are being matured for the construction of refineries abroad, where shortage of refinery capacity is even more marked than it is in the United States.

Another consideration is the lack of sufficient cracking capacity, particularly outside the United States—but also to an important extent within the United States. California, especially lacks adequate cracking capacity and is likely to see the construction of several new plants in the next few years.

Outside the United States it is rumored that the California Arabian Standard Oil Company may be contemplating the construction of a small refinery in Eastern Saudi Arabia to supply products for local consumption. Should such construction be decided upon, it would probably serve as an alternative to another plan which calls for the construction of a submarine pipeline from Bahrein to the mainland. In Brazil, Ipiranga, S.A. plans the construction of a new refinery to charge Peruvian crude. The policy of the Brazilian government expressed in recent legislation makes the construction of a refinery within the country a profitable possibility —tariffs on the importation of refined products have been increased while taxes on imported crude oil remain low. Like France, Italy and other countries, Brazilian policy is encouraging refining within the country.

The Irish National Refineries have finally reached a decision in regard to the construction of a refinery. Obstacles that have delayed this project for so long have been removed. Contracts for the construction and design of the plant will soon be let and present indications are that it will be a 10,000 bbl. per day complete refinery.

The new administration in Iraq has made the construction of a refinery at Kirkuk, to be located near the railroad station, one of the first matters on which they intend to act. It will be remembered that the construction of this refinery has been pending for some time. It will be government owned and operated and will supply domestic demand for petroleum products. It is said that the plant will cost in the neighborhood of $1,250,000. At Abadan, Iran where refinery construction practically never ceases, it is said unofficially that a Dubbs unit will be installed during the coming year.

In England, London and Costal Oil Wharves, Ltd., who already control public storage on Canvey Island at the mouth of the Thames, plan to construct a refinery on that island. Manchester Oil and Refining, Ltd., have finally announced their intention to construct a solvent plant at Trafford Park

near Manchester, England. There have also been rumors of the construction plans of a company who may erect a cracking plant near Rotterdam. The name of the concern interested in this project cannot be announced at this time. Another company is said to be planning a large refinery on the Asiatic side of the Bosphorus.

In Italy, where the refinery construction program undertaken a few years ago, stimulated by laws that encouraged the construction of refineries within the country, has been delayed, a resumption of the program may be expected before very long. Moreover a company has recently been formed in Italy known as Raffineria Olii Minerali per l'Afric del Nord-Anonima (ROMANA) for the purpose of building and operating a refinery at Tripoli, in Libya. While plans have not been revealed, it is said that the plant may be a vapor phase cracking unit of between 700 and 1,000 bbl. per day capacity. Another extremely interesting inquiry originates from British South Africa where the South African Torbanite Mining and Refining Company, Ltd., may erect a small cracking plant to treat torbanite crude. Shell is considering expanding its cracking capacity in Netherland India by 10,000 to 15,000 bbl. per day additional.

In Venezuela, it is obvious that in the near future, Standard of Venezuela and The Texas Company will have to erect refineries, according to the terms of recent concessions granted those companies. At present the Venezuelan government has not reached a decision as to where they will suggest the plants be located. Other details concerning these plants have not of course been decided as yet. The Y.P.F. (Government controlled company) in Argentina has closed a deal with Alco Products for the construction of a Gyro plant including a polymerization unit and clay treating to cost $1,000,000. It is also rumored that an unnamed company contemplates the construction of a 20,000 bbl. per day cracking unit somewhere in Venezuela.

Despite the difficult labor and political situation in Mexico unconfirmed reports indicate that Sinclair and Mexican Eagle may construct large refineries in Mexico, the former in the Papantla section of Vera Cruz, the latter on the Isthmus of Tehuantepec, south of Vera Cruz. Probably nothing will be done on these plans until late spring. Petromex plans modernization and enlargement of its Tampico refinery, including the installation of a Dubbs unit and other improvements. Work is, in fact, now under way and will run to about $200,000. Petromex may also construct a cracking plant near Mexico City at a cost of $1,000,000 to charge Poza Rica crude which will be transported from the field to the refinery by a pipeline which will also have to be built.

In California, it has now become known that Wiltshire plans the addition of a polymerization unit to its new and highly efficient cracking plant at Santa Fe Springs. Construction will probably be done by the company itself, and it is likely that the unit will be a catalytic poly plant costing about $200,000. The Associated Oil Company is starting at once on the building of its 14,500 bbl. per day liquid phase cracking plant, designed by Alco and costing some $1,500,000. The refinery will be located at Avon, California. Union Oil Company's 10,000 bbl. per day cracking plant to be built at Oleum, California should be under construction soon. Over $1,900,000 will be spent on the plant and at this writing it has not been decided whether it will be a Dubbs or Cross unit. An interesting feature of this plant is the plan to back-pump finished products through the natural gasoline pipeline to supply Bakersfield with gasoline. At one time the company is said to have considered the construction of two plants, one of 8,000 bbl. per day to be located at Oleum, the other or 2,000 bbl. per day to be located at Bakersfield. The plan of back pumping gasoline to Bakersfield saves the company the necessity of locating a plant there and effects economies of operation by requiring only one plant in place of the two originally planned.

As much as four or five million dollars may be spent on the Watson refinery of the Richfield Company. Plans call for the expenditure of $2,000,000 to $2,500,000 each on the Watson and Hynes plants, or alternatively, scrapping the Hynes plant and concentrating on the Watson refinery.

Consolidated may be planning to revamp their Parco and Coffyville units into combination plants. They will, however, use their own designs and their own crew for the construction work. The furnaces may be supplied by De Florez. Arthur G. McKee will construct for Dixie Distributors a skimming and cracking plant near Detroit, Michigan. The Dixie Refining Company of Texas also contemplates ordering a 3,500 bbl. per day topping and cracking unit.

A number of plants are planned or are under construction in Texas. J. S. Cosden is

(Continued on page 47)

*Detail of the Lawrenceville, Texas, plant of the Indian Refining Co. (The Texas Co.).*

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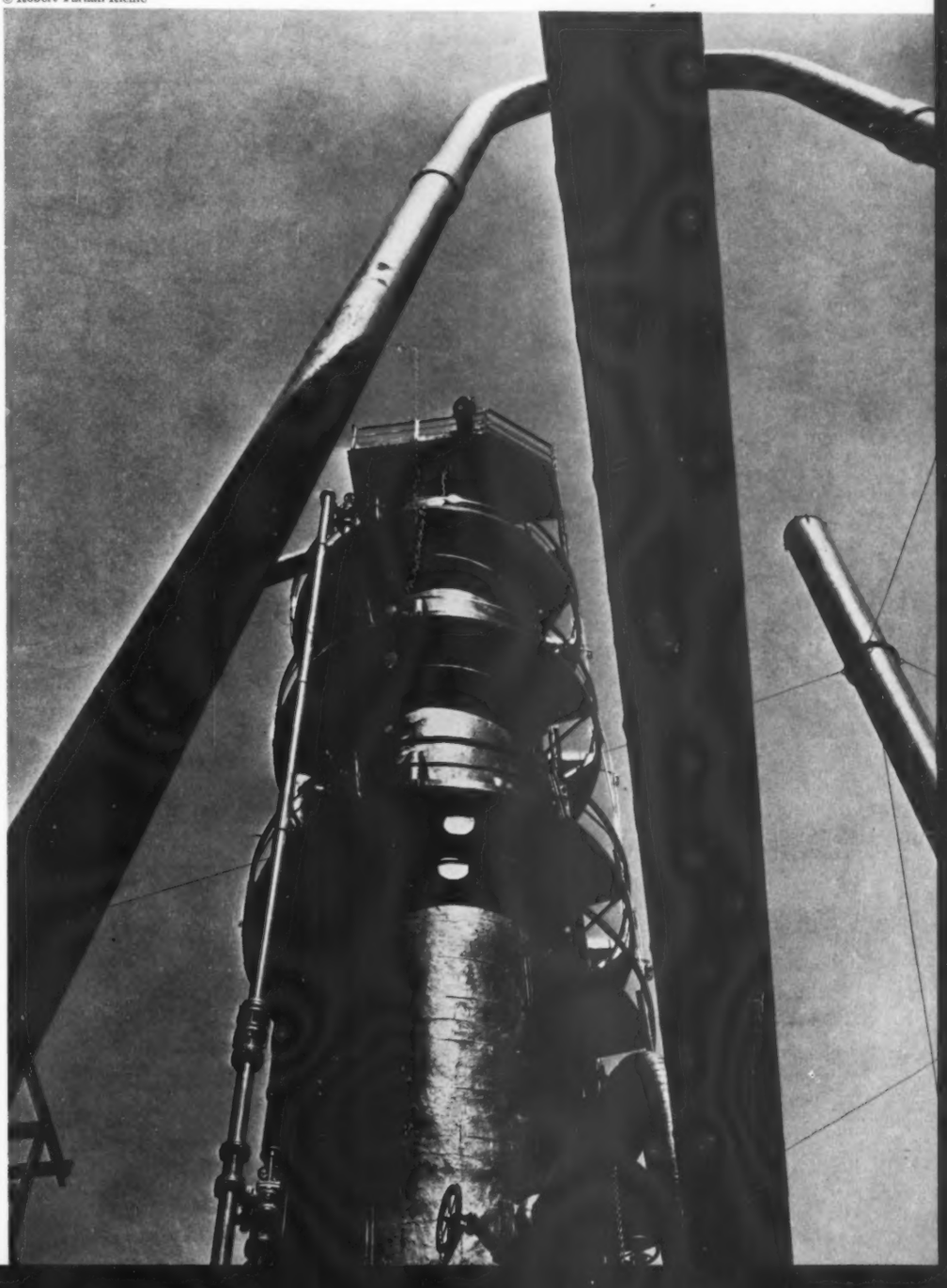


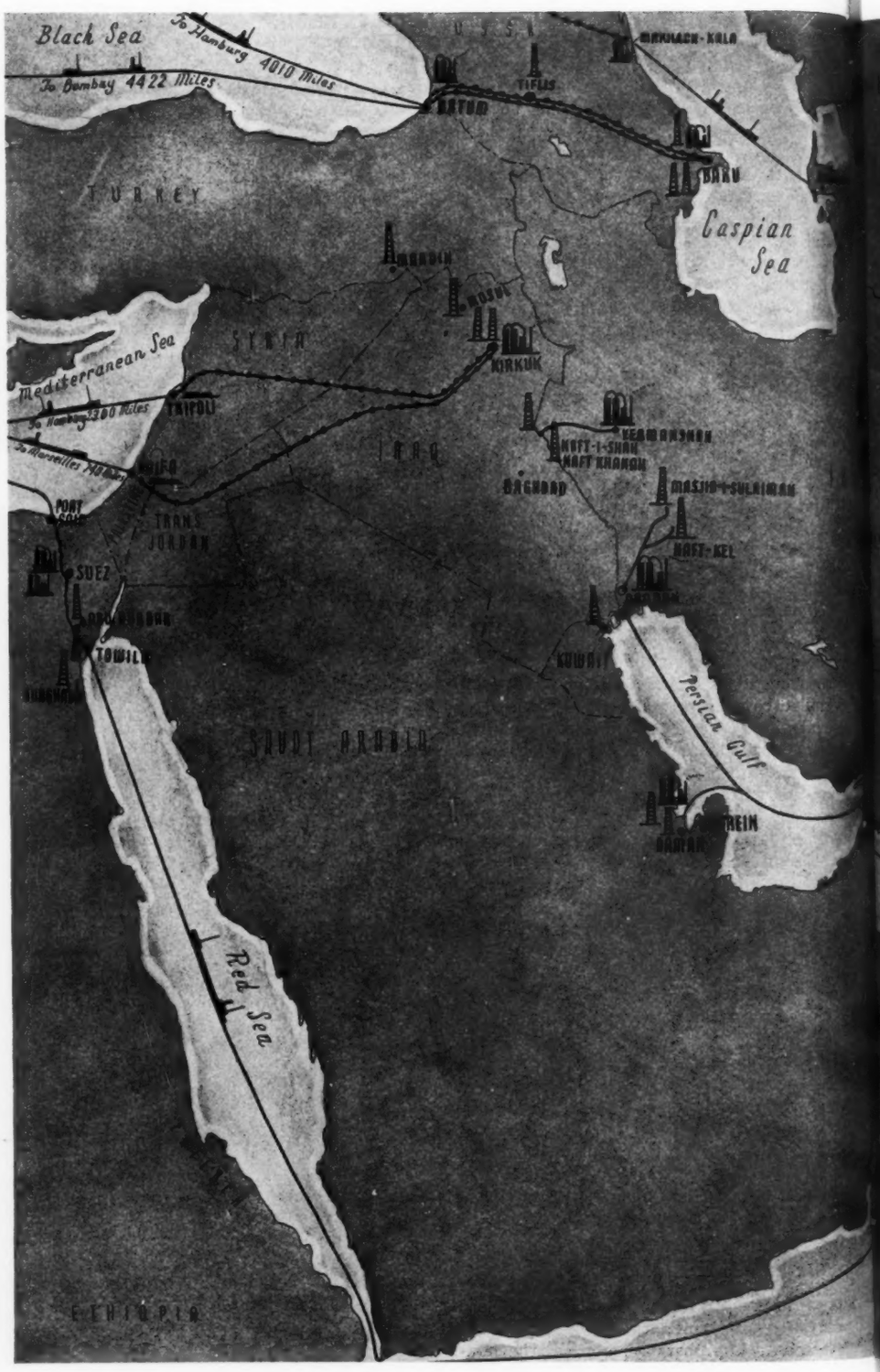
# AFGHANISTAN GRANTS OIL C

ANNOUNCEMENT on December 30 of the signing of an agreement for an oil concession in Afghanistan added one more to the many significant developments of the past year affecting territories of the Near East. The grant just made, if finally ratified, will cover practically the only part of this great area not previously included in one or another of the concessions granted to various international companies.

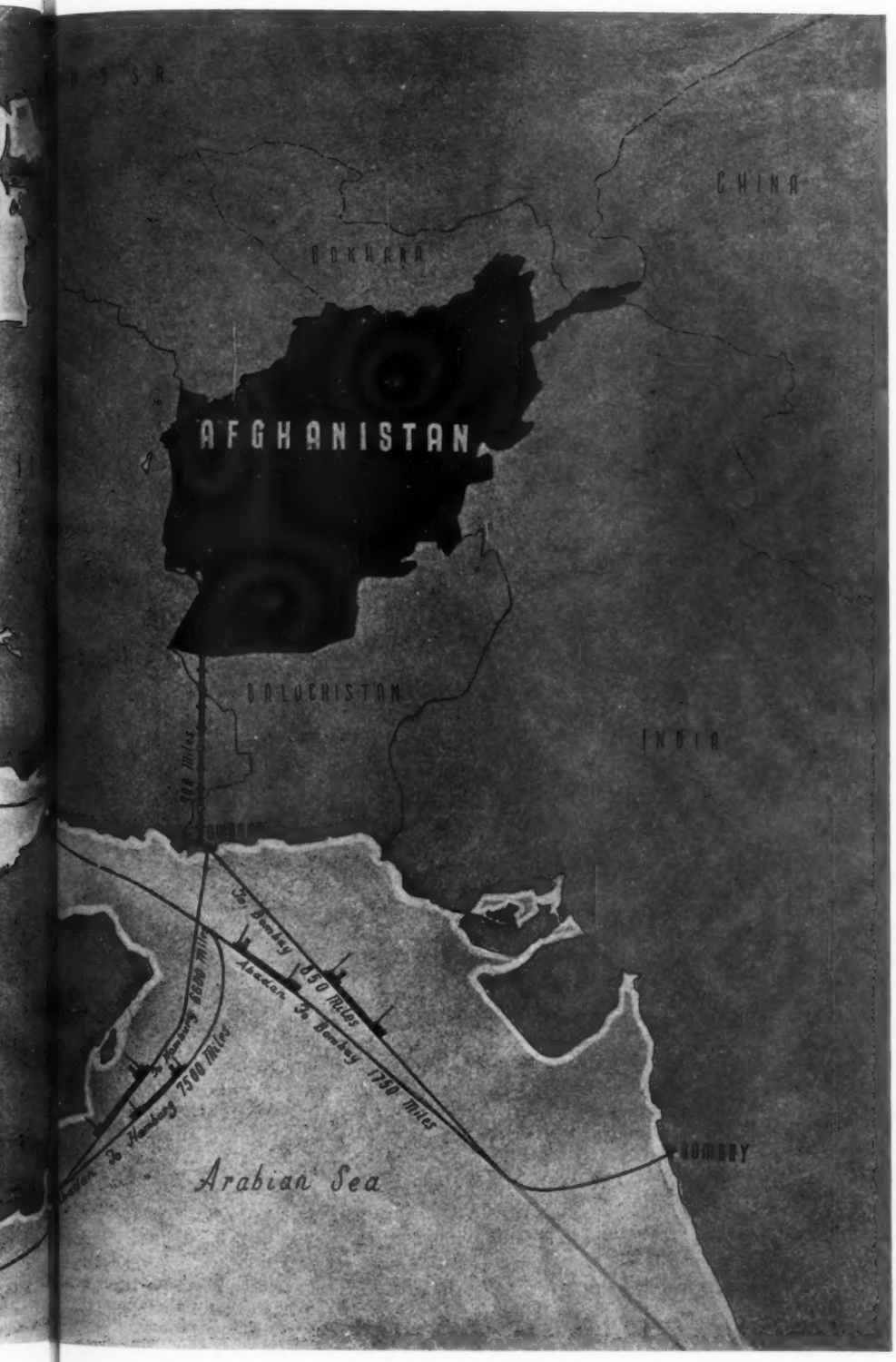
Negotiations leading up to the agreement signed last month have been carried on in Kabul, Geneva and Berlin over a period of several months between Faiz Mohammed Khan, Afghan Minister of Foreign Affairs, and Charles C. Hart, former Minister of the United States to Iran, and Frederick G. Clapp, internationally known geological expert, who has acted as a consultant to various governments in connection with petroleum affairs. The recipient of the concession is the Inland Exploration Company of New York, in which a majority interest is held by the Seaboard Oil Company of Delaware. A minority share in the company is held by the brokerage and investment firm, Case, Pomeroy & Co., and by Ogden L. Mills, formerly Secretary of the Treasury of the United States. The Texas Corporation is interested indirectly through its ownership of a substantial share in Seaboard Oil Company. John M. Lovejoy, president of the Seaboard Company, is also the executive head of Inland Exploration Company. Through Amiranian Oil Company the same interests are understood to be negotiating a concession in Eastern Iran along the Afghanistan border.

The agreement signed in Berlin is still to be approved by the National Assembly of Afghanistan before it becomes effective but it is anticipated that such ratification will encounter no difficulties. While other international interests have been angling for petroleum rights in Afghanistan, officials of that country have been inclined to favor the grant of exploratory and development privileges to American interests because they felt certain that the latter would be interested only in commercial exploitation, and that no political entanglements would follow.

While the exact terms of the concession have not been made public, it is understood that it covers practically the whole area of Afghanistan and is to run for a period of seventy-five years. Exploration is to begin as soon as possible after the final ratification of the agreement. When production reaches a stipulated point, the concessionaire is to erect a refinery to supply the domestic demand for petroleum products and a pipeline to convey the oil output to seaboard.



# L CONCESSION




*Map of Afghanistan showing the relation of this undeveloped but possibly important oil area to other Eastern oil fields. The pipeline is, of course, simply indicated as a possibility, no definite plans for development having yet been announced.*

While newspaper reports relating to the concession refer to Afghan oil fields as being of vast extent and representing "the greatest untapped oil reserve in the world" the fact is that the extent of the petroleum resources of the country is entirely problematical and must remain so until the territory has been subjected to a careful geological survey and to the actual test of the drill. Such geological examinations as have been made in the past have been of a very general nature. The geographical location of Afghanistan in relation to the Iranian oil fields and the general character of its formations suggest the probability that petroleum may be found in the western portion of the country and possibly in an area extending across its northern portion from east to west, but this is only a possibility and the officials of the Seaboard Oil and Inland Exploration companies emphasize the fact that in its present stage the whole enterprise is purely speculative.

Seaboard Oil Company is well known in the United States as an important and successful producer of crude. While this is the first venture of the company into the Eastern Hemisphere it has long been engaged in international operations. In fact, the original name of the company was Mexican Seaboard Oil Company, the title being changed to its present form in 1919. Besides its holdings in the Panuco and Toteco fields in Mexico, which are operated under agreement by the Aguila (Royal Dutch-Shell group), the company has undeveloped concessions in Venezuela. Through Milham Exploration Company it holds a one-fifth interest in the Kettleman North Dome Association in California, and through the Texas Seaboard Oil Company it owns producing properties in East Texas, Long Lake and other Texas fields. Most of its Texas holdings are owned and operated in conjunction with the Sun, Gulf and Tide Water companies.

Officers of the Seaboard Oil Company are John M. Lovejoy, president; C. P. Watson and R. S. McFarland, vice presidents; and B. H. Faulkner, secretary and treasurer. Directors are John M. Lovejoy, Malcolm G. Chace, Harry T. Klein, Ogden L. Mills, R. Ogarrio Garrard Winston, R. C. Gasser and R. C. Shields.

*Casing racks in the San Pedro District of Argentina.*

# JERSEY STANDARD
## Withdraws from Argentina

**Option to Sell Producing, Refining and Marketing Facilities of Its Subsidiary Organization Announced.**

FINDING that conditions imposed by the government of Argentina made it impossible to operate on a commercial basis Standard Oil Company (New Jersey) recently expressed its willingness to dispose of the properties of its subsidiaries in the country and to withdraw entirely from that field. This decision was made effective by an arrangement completed at the end of December by which all the producing, refining and marketing properties in Argentina belonging to companies associated with the Jersey Standard group will be transferred to Yacimientos Petroliferos Fiscales, the government controlled and officially favored Argentine company, subject to the passage of confirming legislation by the Argentine Congress.

Included in the sale are the producing and refining properties of Standard Oil Co. S.A. Argentina and Compania Nacional de Petroleo, and the distributing and marketing facilities of the West India Oil Company throughout Argentina. The producing properties involved are located in the northern producing areas of Argentina in the Province of Salta and the Neuquen territory—districts in which the Y.P.F. is an active producer. The largest of the Standard's Argentine refineries is the one at Campana on the Parana River, an up-to-date topping and cracking plant with a capacity of 11,000 bbl. daily. A 2000-bbl. topping and cracking plant is located at Bahia Blanca and smaller topping plants are at Plaza Huinical and Embarcacion.

Reported terms of the deal place the maximum amount to be paid for these properties at 93,500,000 pesos, or about $30,855,000, with the exact sum to be decided by a mixed commission. The marketing properties were reported to be similarly priced with a maximum figure of 47,000,000 pesos or roundly $15,510,000, subject to final determination by a commission. Payment is to be made in 3½ percent bonds maturing over a period of ten years. The Y.P.F. agrees to retain the operating personnel and foreign technicians of the purchased companies for a period of six months and to give the native workers regular employment.

The documents giving effect to this agreement were signed in Buenos Aires by Ricardo Silveyra, president of Yacimientos Petroli-

*Jersey Standard employees playing golf in Central Camp, Argentina.*

feros Fiscales, and F. C. Schultz, president of Standard Oil Co. S.A. Argentina.

Dissatisfaction with the regulations applied by the Argentine government to the import and distribution of petroleum and its products and with the apparent trend toward nationalization of the oil industry has been growing for several years among companies operating in Argentina. One cause of controversy has been the action of the government in withdrawing from private development the most promising oil lands and declaring these part of the national reserve.

While this policy was being applied government officials criticized the companies having production outside Argentina on the ground that they preferred to import crude for refining rather than to develop the crude oil resources of the country. To this the companies replied quite logically that it was impossible for them to develop domestic resources when all the best lands were segregated into national reserves and only those with meagre possibilities were left open to private drilling. Nevertheless, the accusation against the companies persisted and resulted in the creation of a more or less hostile public opinion.

The situation became acute in July 1936 when the government issued a decree prohibiting exports of petroleum and subjecting imports to a system of limitation and licensing. This action followed the report of a special commission that had been appointed to investigate conditions in the Argentine market. The commission published statistics to show the rapid increase in imports of petroleum and declared that this influx was in excess of current consumption and was continuing without regard to the gradual increase in output of the oil fields of the country. The allegation was made that this was being done deliberately to embarrass the local producers including the Y.P.F. One of the curious charges made in the report was that by overloading the market, particularly in Buenos Aires, "with products of a higher quality than the domestic producers could conveniently deliver" the importing companies were bearing down prices in the expectation that the domestic producers would be driven out of business or rendered competitively negligible. Apparently the implication was that the importing companies should have deteriorated the quality of their products or else should have restricted their outturn to the quantity which the domestic producers were unable to supply.

Acting upon the suggestion of the commission the government promptly established a system of licensing imports. All importers of oil and privately owned refineries operating on imported crude were required to accept import quotas to be fixed by agreement with the Y.P.F. The latter company was to

*Unloading pipe for the Vespucio-Hickman pipeline in Argentina.*

compute the total quantity to be imported on the basis of actual and prospective consumption, provision being made for an adequate reserve.

By this regulation the Y.P.F. which itself controls 65 percent of the domestic production, was placed in virtual charge of its competitors' business. As a check upon its complete monopolization the decree provided that the Y.P.F. should not itself engage in importation. Whatever quantity above domestic production was required to meet the needs of the market was to be assigned to private importers at cost plus administrative charges.

Aside from the above action which was to meet the immediate situation the commission in its report suggested that the Congress enact legislation to provide for permanent control of the industry by establishing a "Consejo Nacional del Petroleo" or National Petroleum Council which should regulate the operations of all petroleum companies including the Y.P.F. This proposal, however, was left for subsequent action.

Representations to the government and efforts by the importing companies to reach some agreement regarding import quotas that they considered acceptable as constituting a workable accord failed to modify the official decree. After some months of discussion along this line the Standard companies apparently came to the conclusion that as they had been unable to operate at a profit under previously existing conditions it was quite hopeless to expect any improvement under the more rigorous restrictions imposed by the decree of last July. The deal for the sale of their properties and their withdrawal from the country was thereupon negotiated.

Whether the government of Argentina will press its nationalization policy to the extent of establishing a complete monopoly is a question on which opinions differ. It is felt by some of those familiar with the situation that the Y.P.F. itself does not desire such a monopoly, its officials being aware that in such an event the company would have to bear the full brunt of such complaints as might arise against high prices, inferiority of products or poor service, whereas now it can be claimed that shortcomings are due to the competition of foreign owned companies. Acquisition of the Standard's holdings if the sale is consummated, will put the Y.P.F. well in the lead as to volume of business compared with other companies operating in Argentina. For the present, however, those companies with outside affiliations apparently prefer to hold on to their positions and to await further developments.

*Jersey Standard's Tomasito No. 1 well in Argentina.*

# THE OIL INDUSTRY LOOKS AHEAD

**By Henry E. Rose**

THE American petroleum industry, taken as a unit, in 1936 closed its best twelve months, profitwise, in seven years, or since 1929. In a few instances companies came through with net income at the highest level in a decade.

With this record behind them, and confronted with a continuance of favorable conditions which characterized results last year, the expectation is that operations in the new year will equal, and probably better, the goal attained in 1936. Several important factors augur well for 1937; namely,

(1) Predictions by leading economists of an uninterrupted upward trend in general business;

(2) Higher prices for commodities, including crude oil, with a consequent compensating advance in prices of refined products;

(3) The best statistical position in fifteen years;

(4) Greater economy in operation, particularly in the replacement of obsolescent refinery equipment with more modern apparatus;

(5) Lower fixed charges resulting from refundings by major companies during 1936 of high interest obligations into lower rate securities, thus effecting savings to redound to the benefit of common stockholders;

(6) Probability of a new record demand for petroleum products; and

(7) World-wide business improvement growing out of the recent agreement among leading nations (United States, Great Britain and France, and subsequently other nations) to stabilize currencies in exchange markets, thus facilitating the movement of international trade.

In substantiation of the factors mentioned above, it may be well to explain briefly those which require an explanation, and also to quote from the predictions of leading economists.

Both Colonel Leonard P. Ayres, vice president of the Cleveland Trust Co., and George E. Roberts, vice president of the National City Bank of New York, economists, state it as their opinions that general business in 1937 will be better than that in 1936. In addition, numerous executives in the oil, automotive, steel, electrical, banking and other industries have expressed similar optimism.

Colonel Ayres envisages betterment "in spite of unrest that prevails in much of the world, the labor difficulties which may develop here, and the new legislation that Congress may enact." Mr. Roberts, declaring that 1937 "opens with great expectations," adds that for four years the economic system has been "pulling itself together."

Simultaneously, both Colonel Ayres and Mr. Roberts feel that commodity prices are tending in an upward direction. The former says that "wholesale and retail commodity prices and the cost of living will probably advance next year (1937), but it does not seem likely that the increases will be very large."

Mr. Roberts, writing in his bank's monthly business letter, comments that "unquestionably the rise in staple commodity prices has been one of the most important developments of 1936, and one holding great promise for 1937."

As for crude oil, specifically, leaders in the petroleum industry, privately and for publication, have taken the stand that a higher price for this commodity is warranted. Three principal reasons for this view are cited: namely, (a) the higher cost of finding and lifting oil incident to deeper drilling; (b) proration laws of states controlling output per well and lowering the return on the investment; and (c) heavy drafts on storage stocks of crude above ground to meet unprecedented demand for refined products with the result that crude inventories have been reduced to the lowest level in almost fifteen years, and to a point where, economically, it would be unwise to permit them to decline further.

The strong statistical position of the industry is demonstrated not alone in the low level of inventories of crude oil, but also by the enforcement, by legislation, in leading producing states, of rigid control over production to prevent waste and still meet the market demand. At no time in the history of the oil industry, perhaps, has there been such effective control over production as in the past two years. Refining and marketing have benefited from this balance in production and demand through better average prices for refined products.

As for expenditures this year to improve refinery equipment, it is the opinion of some executives that these are likely to be at the highest level in several years and top those made in 1936. It is pointed out that such expenditures were kept at a minimum during the depression with the result that there is much equipment which is not capable of maximum efficiency in production.

Forecasts of demand for petroleum products in 1937, by leaders in the industry, range from 7 percent to 9 percent higher than in 1936. Of necessity, these are based on larger sales of automobiles, a continuance of oil burner installations in both new and old homes, and greater use of oil products by industry in line with the general business betterment. Such predictions mean another new all-time high record for the industry.

The savings effected in refunding operations in the past year are dwelt on at greater length in subsequent paragraphs of this article and need no explanation here. Likewise, it is unnecessary to comment further on the world-wide business improvement which should result from the movement of leading nations to stabilize currencies in exchange markets.

Of particular benefit to American companies last year were higher average prices for both crude and refined products, a better marketing situation and a record demand. The result—twenty-three companies piled up net income aggregating some $425,000,000, marking an improvement of about 60 percent compared with 1935. In the latter year profits totaled slightly more than $275,000,000 for these identical units.

While the recovery in the oil industry from the nadir of the depression has been good in the past two years, it has lagged in comparison with other leading industries. Last year's profits, as a matter of fact, were still considerably below those of 1929, the pre-depression year, when ten of the principal corporations alone earned $476,000,000, or about $50,000,000 more than did twenty-three companies for 1936. During 1931 and 1933 their operations (23 companies) were conducted at losses of $91,000,000 and $7,500,000, respectively. The industry, hence, has much ground to cover to equal its 1929 earnings.

The 1936 profit results, expressed in relation to common stock outstanding, were equal to approximately $2.30 a share on the average number of shares in the hands of the public, after allowing for preferred dividends. This compared with per share earnings of about $1.50 on common stock in 1935.

For all of 1936 the estimated net income, per common share of some leading companies, follows: Texas Corp. $4; Continental

# FIVE YEAR FINANCIAL REVIEW—U. S. Oil Companies

| Amerada Corp. | Net Income | Per Share of Com. | Net Working Capital | Net Capital Assets | Funded and/or Long Term Debt | No. of Pref. Shares | No. of Com. Shares | Surplus |
|---|---|---|---|---|---|---|---|---|
| (l) 1936 | $1,405,632 | $1.78 | (m) | (m) | $ ..... | ..... | 788,675 | (m) |
| 1935 | 1,797,613 | 2.28 | $5,008,667 | $9,227,589 | ..... | ..... | 788,675 | $3,826,392 |
| 1934 | 1,736,420 | 2.20 | 5,096,673 | 8,966,293 | ..... | ..... | 788,675 | 3,606,129 |
| 1933 | 380,443 | .50 | 4,942,424 | 8,576,743 | ..... | ..... | 767,375 | 3,424,559 |
| 1932 | 1,147,207 | 1.48 | 7,328,270 | 7,692,714 | ..... | ..... | 774,875 | 4,609,669 |
| 1931 | (d) 1,701,648 | ... | 6,762,882 | 8,555,916 | ..... | ..... | 766,275 | 5,283,874 |
| **Atlantic Refining Co.** | | | | | | | | |
| (l) 1936 | 6,161,200 | 2.20 | (m) | (m) | (m) | ..... | 2,664,000 | (m) |
| 1935 | 3,970,598 | 1.49 | 36,512,103 | 111,157,824 | 14,023,623 | ..... | 2,664,901 | 65,617,388 |
| 1934 | 5,512,105 | 2.07 | 37,960,843 | 109,739,314 | 14,024,734 | ..... | 2,664,902 | 66,791,823 |
| 1933 | 6,556,377 | 2.46 | 20,015,187 | 104,489,510 | 14,046,793 | ..... | 2,665,234 | 64,202,597 |
| 1932 | 3,918,021 | 1.45 | 34,945,032 | 107,179,944 | 14,070,793 | ..... | 2,696,642 | 61,144,504 |
| 1931 | 513,750 | .19 | 35,285,503 | 106,607,650 | 14,594,759 | ..... | 2,696,642 | 60,286,415 |
| **Barnsdall Oil Co.** | | | | | | | | |
| (l) 1936 | 1,719,584 | .76 | (m) | (m) | (m) | ..... | 2,249,974 | (m) |
| 1935 | 741,136 | .34 | 2,152,780 | 7,659,141 | ..... | ..... | 2,131,090 | 7,256,270 |
| 1934 | (d) 1,029,447 | ... | 3,719,365 | 14,968,355 | 318,510 | ..... | 2,205,451 | 9,096,713 |
| 1933 | (d) 1,942,635 | ... | 3,760,360 | 15,522,433 | ..... | ..... | 2,258,779 | 10,695,191 |
| 1932 | (d) 847,072 | ... | 2,915,649 | 17,246,832 | ..... | ..... | 2,258,779 | 12,693,772 |
| 1931 | (d) 3,268,637 | ... | 3,692,339 | 49,610,291 | 88,100 | ..... | 2,258,779 | 1,583,734 |
| **Consolidated Oil Corp.** | | | | | | | | |
| (n) 1936 | 7,029,314 | .49 | (m) | (m) | 50,000,000 | (m) | 13,944,886 | (m) |
| 1935 | 11,306,904 | .74 | 78,377,440 | 200,965,255 | 40,181,938 | 106,028 | 13,983,237 | 180,540,203 |
| 1934 | 553,282 | (e) 5.43 | 75,099,378 | 208,402,801 | 47,343,015 | 101,844 | 13,996,172 | 175,399,041 |
| 1933 | 133,580 | (e) 1.28 | 92,983,007 | 204,832,796 | 53,790,823 | 104,144 | 14,025,551 | 176,234,473 |
| 1932 | (b) 1,601,039 | .05 | 101,923,567 | 210,840,320 | 59,528,643 | 111,594 | 14,218,835 | 189,656,802 |
| 1931 | (d) 22,010,172 | ... | (c) 119,056,353 | 214,444,482 | 64,231,473 | 129,694 | 14,218,835 | 189,980,527 |
| **Continental Oil Corp.** | | | | | | | | |
| (l) 1936 | 8,083,624 | 1.72 | 30,562,217 | 43,912,421 | ..... | ..... | 4,682,625 | 60,260,193 |
| 1935 | 8,813,561 | 1.88 | 31,154,643 | 39,825,881 | ..... | ..... | 4,682,664 | 56,880,127 |
| 1934 | 4,865,358 | 1.03 | 25,390,339 | 40,647,154 | ..... | ..... | 4,738,593 | 51,780,703 |
| 1933 | 2,275,860 | .48 | 29,628,797 | 41,922,070 | 8,025,409 | ..... | 4,738,593 | 48,549,652 |
| 1932 | (d) 1,444,133 | ... | 27,277,384 | 42,776,264 | 9,546,263 | ..... | 4,738,593 | 45,504,505 |
| 1931 | (d) 12,045,575 | ... | 23,922,822 | 99,197,042 | 10,614,638 | ..... | 4,743,924 | 30,326,314 |
| **Creole Petroleum Corp.** | | | | | | | | |
| 1935 | 5,509,067 | .79 | 8,229,979 | 52,877,364 | ..... | ..... | 6,974,356 | 27,357,909 |
| 1934 | 5,315,254 | .76 | 5,174,439 | 51,926,430 | ..... | ..... | 6,974,356 | 22,657,566 |
| 1933 | 4,106,099 | .59 | 3,356,137 | 52,792,209 | ..... | ..... | 6,974,356 | 22,102,453 |
| 1932 | 2,075,403 | .30 | 3,342,909 | 50,222,565 | ..... | ..... | 6,974,356 | (d) 4,018,368 |
| 1931 | (d) 4,510,465 | ... | 2,475,210 | 48,089,250 | ..... | ..... | 6,974,356 | (d) 7,139,027 |
| **Gulf Oil Corp.** | | | | | | | | |
| 1935 | 10,551,720 | 2.32 | 96,410,624 | 288,757,680 | 87,166,000 | ..... | 4,538,101 | 199,049,566 |
| 1934 | 2,811,183 | .62 | 97,615,006 | 283,076,187 | 91,629,847 | ..... | 4,538,101 | 189,737,492 |
| 1933 | (d) 11,386,387 | ... | 90,174,574 | 276,725,868 | 102,462,863 | ..... | 4,538,101 | 190,155,467 |
| 1932 | 2,743,492 | .60 | 96,748,097 | 285,494,570 | 110,463,195 | ..... | 4,538,101 | 195,567,278 |
| 1931 | (d) 23,670,052 | ... | 98,058,836 | 596,196,804 | 125,559,392 | ..... | 4,525,221 | 195,676,193 |
| **Humble Oil & Refining Co.** | | | | | | | | |
| 1935 | 23,966,326 | 2.66 | 29,002,746 | 204,138,789 | 487,610 | ..... | 9,000,000 | 53,499,275 |
| 1934 | 21,989,954 | 2.45 | 31,580,204 | 193,059,994 | 6,831,050 | ..... | 8,968,479 | 38,078,401 |
| 1933 | 20,847,817 | 2.32 | 46,952,934 | 179,020,501 | 18,950,000 | ..... | 8,985,666 | 132,405,573 |
| 1932 | 14,896,613 | 1.65 | 45,123,591 | 167,504,927 | 18,950,000 | ..... | 8,985,666 | 117,589,683 |
| 1931 | 2,765,092 | .93 | 66,295,168 | 162,482,937 | 42,944,000 | ..... | 2,974,645 | 109,567,972 |
| **Imperial Oil, Ltd.** | | | | | | | | |
| 1935 | 25,229,850 | .94 | 72,607,155 | 53,572,421 | ..... | ..... | 26,965,078 | 89,211,976 |
| 1934 | 25,771,653 | .96 | 69,055,219 | 58,520,697 | ..... | ..... | 26,919,871 | 97,678,704 |
| 1933 | 14,101,561 | .52 | 49,243,315 | 65,053,656 | ..... | ..... | 26,857,152 | 110,645,191 |
| 1932 | 14,713,238 | .55 | 49,310,547 | 69,883,456 | ..... | ..... | 26,783,092 | 109,958,799 |
| 1931 | 18,226,894 | .68 | 60,278,383 | (a) 121,050,292 | ..... | ..... | 26,742,792 | 108,584,328 |
| **Mid-Continent Petroleum Corp.** | | | | | | | | |
| (l) 1936 | 4,198,678 | 2.26 | 18,542,816 | (m) | ..... | ..... | 1,855,912 | (m) |
| 1935 | 2,417,175 | 1.31 | 17,132,369 | 36,662,598 | ..... | ..... | 1,857,912 | 38,311,091 |
| 1934 | 828,093 | .45 | 15,133,343 | 36,947,518 | ..... | ..... | 1,843,872 | 36,893,649 |
| 1933 | (d) 1,766,438 | ... | 14,779,310 | 50,559,281 | ..... | ..... | 1,857,912 | 13,174,089 |
| 1932 | (d) 2,081,900 | ... | 14,034,087 | 53,942,030 | ..... | ..... | 1,857,912 | 14,971,218 |
| 1931 | (d) 4,962,411 | ... | 14,832,082 | 54,949,054 | ..... | ..... | 1,857,912 | 17,032,576 |
| **Ohio Oil Co.** | | | | | | | | |
| (l) 1936 | 6,212,981 | .57 | 32,655,510 | (k) 94,120,004 | ..... | 548,077 | 6,563,377 | 20,002,650 |
| 1935 | 5,488,267 | .33 | 32,155,437 | (k) 93,314,153 | ..... | 548,077 | 6,563,377 | 17,915,323 |
| 1934 | 5,411,924 | .32 | 33,740,981 | (k) 95,599,183 | ..... | 580,943 | 6,648,052 | 10,789,515 |
| 1933 | (d) 133,016 | ... | 32,438,578 | 99,028,129 | ..... | 580,943 | 6,648,052 | 11,672,319 |
| 1932 | 7,242,981 | .58 | 27,942,774 | (k) 100,050,004 | ..... | 580,796 | 6,648,052 | 17,565,680 |
| 1931 | (d) 21,488,763 | ... | 26,460,602 | (k) 99,232,312 | ..... | 580,668 | 6,648,052 | 17,046,670 |
| **Phillips Petroleum Co.** | | | | | | | | |
| (l) 1936 | 12,834,905 | 3.08 | (p) 18,833,521 | (p) 142,616,796 | (p) 15,900,000 | ..... | (r) 4,165,643 | (p) 25,137,922 |
| 1935 | 13,421,703 | 3.23 | 23,450,267 | 137,258,621 | 20,945,221 | ..... | 4,152,836 | 21,954,036 |
| 1934 | 5,757,308 | 1.38 | 21,601,235 | 136,992,626 | 26,393,309 | ..... | 4,153,235 | 13,721,113 |
| 1933 | 1,300,695 | .36 | 19,652,248 | 141,510,522 | 29,983,963 | ..... | 4,154,687 | 12,116,812 |
| 1932 | 775,766 | .18 | 13,579,510 | 149,656,040 | 33,329,962 | ..... | 4,153,104 | 10,616,117 |
| 1931 | (d) 5,576,409 | ... | 5,910,547 | 159,785,585 | 36,373,836 | ..... | 4,165,295 | 25,079,333 |
| **Pure Oil Co.** | | | | | | | | |
| 1935 | 8,150,026 | 2.00 | 24,685,287 | 110,753,615 | 38,743,113 | 309,000 | 3,038,700 | 41,728,169 |
| 1934 | (d) 884,872 | ... | 12,175,503 | 108,456,105 | 28,500,000 | 300,270 | 3,038,700 | 34,768,621 |
| 1933 | 811,086 | (g) 2.75 | 12,804,584 | 102,602,376 | 30,500,000 | 300,270 | 3,038,700 | 35,766,659 |
| 1932 | 642,386 | (g) 2.14 | 12,866,311 | 104,397,973 | 32,500,000 | 300,270 | 3,038,700 | 35,075,043 |
| 1931 | (h) 470,177 | (g) 1.56 | 14,465,131 | 175,219,429 | 34,500,000 | 300,000 | 3,038,700 | 59,268,846 |

| Seaboard Oil Co. | Net Income | Per Share of Com. | Net Working Capital | Net Capital Assets | Funded and/or Long Term Debt | No. of Pref. Shares | No. of Com. Shares | Surplus |
|---|---|---|---|---|---|---|---|---|
| (l) 1936 | $1,837,296 | $1.47 | (m) | (m) | $ | | 1,244,383 | (m) |
| 1935 | 1,670,847 | 1.34 | $2,149,116 | $5,660,271 | | | 1,244,383 | $1,843,158 |
| 1934 | 1,375,590 | 1.10 | 2,323,826 | 5,523,004 | | | 1,244,383 | 1,416,694 |
| 1933 | 1,275,565 | 1.02 | 2,826,454 | 5,460,401 | | | 1,244,383 | 1,285,487 |
| 1932 | 858,172 | .71 | 2,103,481 | 5,459,451 | | | 1,244,383 | 763,842 |
| 1931 | 123,711 | .10 | 1,939,568 | 5,173,296 | | | 1,244,383 | (d) 3,479,627 |
| **Shell Union Oil Corp.** | | | | | | | | |
| (l) 1936 | (s) 16,512,053 | 1.14 | (m) | (m) | (m) | 388,166 | 13,070,625 | (m) |
| 1935 | 6,812,835 | .37 | 41,353,931 | 261,648,294 | 50,153,979 | 388,166 | 13,070,625 | 3,419,589 |
| 1934 | (d) 949,111 | ... | 39,068,934 | 260,050,464 | 53,581,227 | 400,000 | 13,070,625 | (d) 18,435,042 |
| 1933 | (d) 5,250,290 | ... | 56,784,051 | 270,029,142 | 81,540,451 | 400,000 | 13,070,625 | (d) 17,081,141 |
| 1932 | (d) 4,288,496 | ... | 59,651,206 | 285,784,252 | 96,190,376 | 400,000 | 13,070,625 | (d) 12,840,176 |
| 1931 | (d) 27,008,310 | ... | 70,281,199 | 532,645,336 | 127,077,204 | 400,000 | 13,070,625 | (d) 12,501,109 |
| **Skelly Oil Co.** | | | | | | | | |
| (l) 1936 | 3,511,431 | 3.19 | (m) | (m) | (m) | 66,300 | 1,008,549 | (m) |
| 1935 | 2,585,849 | 2.16 | 5,946,672 | 33,260,799 | 8,756,859 | 66,300 | 1,008,548 | 9,335,556 |
| 1934 | 713,577 | .30 | 5,841,952 | 31,527,488 | 9,615,679 | 67,000 | 1,008,548 | (d) 2,745,942 |
| 1933 | (d) 1,107,661 | ... | 7,956,075 | 29,563,306 | 9,814,000 | 74,800 | 1,008,548 | (d) 3,795,193 |
| 1932 | (d) 1,043,682 | ... | 8,059,963 | 32,824,685 | 10,935,500 | 94,300 | 1,008,548 | (d) 4,173,036 |
| 1931 | (d) 2,117,110 | ... | 7,610,693 | 35,723,862 | 11,912,000 | 114,000 | 1,011,753 | (d) 5,086,730 |
| **Socony-Vacuum Oil Co., Inc.** | | | | | | | | |
| (n)(t) 1936 | 20,000,000 | .63 | (m) | (m) | (m) | | 31,708,456 | (m) |
| 1935 | 22,525,892 | .71 | 186,858,832 | 400,094,099 | 74,326,495 | | 31,708,456 | 146,736,060 |
| 1934 | 24,121,297 | .76 | 184,148,471 | 400,204,514 | 85,014,584 | | 31,154,279 | 138,588,901 |
| 1933 | 22,545,462 | .71 | 208,663,144 | 613,445,907 | 83,312,556 | | 30,905,006 | 55,866,705 |
| 1932 | 5,320,282 | .17 | 238,259,829 | (j) 672,149,125 | 88,687,021 | | 31,019,693 | 50,494,006 |
| 1931 | (d) 4,169,248 | ... | 259,073,230 | (j) 699,314,437 | 99,355,586 | | 31,744,533 | 86,692,551 |
| **Standard Oil Co. of California** | | | | | | | | |
| (l) 1936 | 16,665,074 | 1.28 | (m) | (m) | (m) | | 13,014,754 | (m) |
| 1935 | 18,594,330 | 1.42 | 62,647,719 | 445,640,587 | 5,000,000 | | 13,102,900 | 212,453,308 |
| 1934 | 18,327,807 | 1.40 | 80,120,833 | 437,191,071 | | | 13,102,900 | 211,733,009 |
| 1933 | 7,560,903 | .58 | 85,290,291 | 446,139,358 | | | 13,102,900 | 213,630,216 |
| 1932 | 13,994,992 | 1.07 | 80,711,983 | 458,666,507 | | | 13,102,900 | 223,272,323 |
| 1931 | 14,559,593 | 1.11 | 80,866,334 | 470,713,077 | | | 13,102,900 | 235,662,653 |
| **Standard Oil Co. of Indiana** | | | | | | | | |
| (n) 1936 | 22,015,537 | 1.45 | (m) | (m) | (m) | | 15,215,677 | (m) |
| 1935 | 30,179,895 | 1.98 | 170,876,326 | 366,184,636 | 10,579,963 | | 15,215,677 | 253,905,946 |
| 1934 | 18,949,680 | 1.25 | 182,889,895 | 275,715,684 | 8,413,670 | | 15,215,677 | 226,267,121 |
| 1933 | 17,674,351 | 1.14 | 192,298,854 | 306,632,853 | 7,677,413 | | 15,528,504 | 228,047,576 |
| 1932 | 16,558,282 | 1.04 | 203,452,389 | 308,881,744 | 37,140,256 | | 15,941,894 | 227,415,764 |
| 1931 | 17,596,396 | 1.04 | 214,897,728 | 481,715,520 | 48,229,461 | | 16,908,543 | 242,316,116 |
| **Standard Oil Co. (N. J.)** | | | | | | | | |
| 1935 | 62,863,192 | 2.43 | 425,337,478 | 1,054,520,041 | 82,772,730 | | 25,856,081 | 448,127,942 |
| 1934 | 45,618,960 | 1.76 | 407,165,346 | 1,082,380,163 | 141,461,816 | | 25,856,081 | 449,062,205 |
| 1933 | 25,084,310 | .97 | 407,177,198 | 1,060,449,508 | 179,398,236 | | 25,761,465 | 507,846,292 |
| 1932 | 282,865 | .01 | 447,151,246 | 1,148,830,800 | 207,245,001 | | 25,740,965 | 520,556,406 |
| 1931 | 8,704,758 | .34 | 585,238,363 | 1,129,910,915 | 173,442,017 | | 25,735,468 | 592,493,162 |
| **Standard Oil Co. of Ohio** | | | | | | | | |
| 1935 | 2,690,647 | 2.77 | 11,245,428 | 34,427,880 | 741,915 | 120,000 | 753,740 | 15,275,632 |
| 1934 | (d) 1,913,735 | ... | 8,670,081 | 35,771,654 | 266,800 | 120,000 | 753,740 | 13,184,984 |
| 1933 | (d) 823,357 | ... | 10,600,970 | 34,619,520 | 305,855 | 120,000 | 753,740 | 15,945,709 |
| 1932 | (d) 1,206,361 | ... | 10,382,424 | 38,571,056 | 326,035 | 120,000 | 753,740 | 17,691,344 |
| 1931 | 2,359,173 | 2.34 | 11,383,276 | 41,106,597 | 395,731 | 120,000 | 752,467 | 21,096,018 |
| **Sun Oil Co.** | | | | | | | | |
| (n) 1936 | 3,474,811 | 1.57 | (p) 22,418,921 | (p) 62,899,598 | (p) 6,245,530 | 100,000 | 2,023,542 | (p) 11,549,957 |
| 1935 | 7,100,239 | 3.45 | 20,043,466 | 62,787,994 | 6,675,681 | 100,000 | 2,030,988 | 9,512,101 |
| 1934 | 6,650,464 | 3.51 | 16,250,464 | 62,545,483 | 6,500,000 | 100,000 | 1,893,982 | 9,609,319 |
| 1933 | 6,971,844 | 4.04 | 18,134,634 | 60,640,679 | 10,541,000 | 100,000 | 1,576,697 | 10,778,750 |
| 1932 | 4,198,046 | 2.35 | 17,243,193 | 60,440,669 | 11,864,000 | 100,000 | 1,531,422 | 10,999,863 |
| 1931 | 3,107,147 | 1.63 | 16,325,540 | 60,207,448 | 12,131,000 | 100,000 | 1,535,456 | 11,502,220 |
| **Texas Corp.** | | | | | | | | |
| (l)(t) 1936 | 28,000,000 | 3.02 | (m) | (m) | (m) | | 9,340,069 | (m) |
| 1935 | 17,065,037 | 1.83 | 125,756,164 | 257,074,288 | 93,253,676 | | 9,340,069 | 103,074,635 |
| 1934 | 5,545,205 | .59 | 119,372,463 | 266,660,893 | 103,600,076 | | 9,349,733 | 103,232,978 |
| 1933 | (d) 491,004 | ... | 126,073,698 | 266,020,236 | 104,092,777 | | 10,352,371 | 111,612,312 |
| 1932 | (d) 2,161,841 | ... | 133,426,320 | 286,637,122 | 109,804,745 | | 10,486,368 | 134,352,282 |
| 1931 | (d) 9,954,478 | ... | 155,486,505 | 301,719,735 | 117,845,877 | | 10,851,237 | 150,866,663 |
| **Tide Water Associated Oil Co.** | | | | | | | | |
| (l) 1936 | 8,504,933 | .99 | (u) 35,674,220 | (u) 118,986,066 | (u) 20,074,657 | 626,221 | (r) 5,722,826 | (u) 24,290,676 |
| 1935 | 7,865,701 | .73 | 33,682,501 | 117,806,258 | 19,774,335 | 626,221 | 5,642,342 | 21,336,760 |
| 1934 | 5,810,657 | .35 | 41,220,500 | 113,226,094 | 2,504,892 | 636,222 | 5,631,341 | 20,620,669 |
| 1933 | 7,265,301 | .61 | 43,241,327 | 114,383,792 | 9,280,790 | 643,023 | 5,618,672 | 20,967,673 |
| 1932 | 4,718,693 | .13 | 37,765,931 | 119,982,364 | 13,218,754 | 666,524 | 5,611,040 | 13,694,604 |
| 1931 | (d) 5,818,671 | ... | 43,313,115 | 146,978,320 | 16,626,294 | 684,552 | 5,780,907 | 13,739,247 |
| **Union Oil Co. of California** | | | | | | | | |
| (l) 1936 | 4,400,000 | 1.00 | (m) | (m) | (m) | | 4,386,070 | (m) |
| 1935 | 5,038,286 | 1.15 | 35,545,741 | 108,543,534 | 21,526,500 | | 4,386,070 | 14,120,970 |
| 1934 | 2,902,733 | .66 | 35,976,560 | 107,956,010 | 21,489,500 | | 4,386,070 | 13,914,222 |
| 1933 | 1,954,279 | .45 | 42,640,151 | 139,738,680 | 26,687,000 | | 4,386,070 | 47,060,129 |
| 1932 | 3,211,084 | .73 | 45,739,877 | 144,881,088 | 31,609,145 | | 4,386,070 | 50,673,657 |
| 1931 | 3,054,913 | .70 | 47,675,448 | 147,888,106 | 32,546,500 | | 4,386,070 | 55,028,849 |

(a) Before reserves for depreciation.
(b) Eleven months ended December 31, 1932.
(c) As of January 1, 1932.
(d) Deficit.
(e) On preferred stock.
(g) On $100 par combined 5¼, 6 and 8% preferred stocks.
(h) Year ended March 31, 1932.
(j) Including good will, appreciation of properties, etc.
(k) Exclusive of good will, patents, etc.
(l) Nine months ended September 30.
(m) Not available.
(n) Six months ended June 30.
(p) As of June 30.
(r) Average number of shares outstanding in period.
(s) Including profit of $2,909,087 from investment sale.
(t) Official estimate.
(u) As of July 31.

Oil $2.25; Socony-Vacuum $1.30; Skelly Oil $4; Tide Water Associated Oil $1.26; Mid-Continent Petroleum $2.50; Phillips Petroleum $4; Shell Union Oil $1.50; Standard Oil Co. (N. J.) $3.00–3.50; Consolidated Oil $1.15; Barnsdall Oil $1; Seaboard Oil $1.95; Ohio Oil $.70; Standard Oil of Indiana $3.25–3.40; Standard Oil of California $1.75; Union Oil $1.45; Amerada Corp. $2.45; Atlantic Refining $2.50–2.70; Humble Oil & Refining $3–3.25 and Sun Oil $3.25.

Operations of these companies in the first nine months of 1936 revealed some startling gains as compared with the similar period of 1935. In a number of instances the first three quarters' results topped, by a substantial margin, the net income for all of 1935. In the latter category, based on reports rendered, are included Shell Union Oil; Atlantic Refining; Barnsdall Oil (which in mid-year 1935 converted to a producing company); Mid-Continent Petroleum; Ohio Oil; Skelly Oil; The Texas Corp. and Tide Water Associated Oil Co.

Barnsdall registered a gain of 780 percent in the first nine months of 1936 over the similar period in 1935; Shell Union Oil, including a profit of $2,909,000 on sale of an investment, of 280 percent; Atlantic Refining of 220 percent; Mid-Continent Petroleum of 190 percent; Skelly Oil of 120 percent and Ohio Oil of 57 percent. Over all of 1935, Shell Union's nine months' operations of 1936 scored a gain of 140 percent; Barnsdall of 130 percent; Mid-Continent of 73 percent and The Texas Corp. of 65 percent.

Because of the sharp betterment in 1936 profits, and due also to provisions of the Revenue Act of 1936 which imposes a tax on undistributed profits, the leading oil companies, taken as a whole, distributed the largest dividend payments to stockholders in five years. As compared with 1935, several, besides paying extras, increased regular rates; others, which previously had paid intermittently, adopted regular bases; two paid off all arrearages on preferred issues and two others distributed stock dividends.

Of the twenty-three leading American companies, twenty-one paid cash dividends on their common stock last year aggregating $218,000,000. In the previous year only seventeen companies in the group disbursed $116,585,000 in cash payments. On common stock outstanding in 1936 the dividend payments averaged $1.25 a share against $.80 a share for the seventeen companies in 1935. The two companies which paid no dividends on common stock last year were Skelly Oil Co., which, however, liquidated the entire arrearage of some $1,800,000 on its preferred shares, and consequently paved the way for a resumption of payments on the junior shares, and Pure Oil Co.

Shell Union Oil Co., besides clearing arrears on its preferred stock, aggregating $9,900,000, also paid a dividend of 25 cents a share on its 13,070,625 shares of common stock, the first such payment since the summer of 1930.

Gulf Oil Corp. increased its capital stock from $120,000,000 to $300,000,000, and subsequently paid a common stock dividend of 100 percent to its shareholders. In addition, it disbursed cash dividends of $1.50 a share on common stock last year, the first payments since 1931.

Sun Oil Co. was the other corporation to pay out a stock dividend to its common holders. It was for 6 percent and compared with a payment of 7 percent in 1935. Cash payments by Sun to its junior holders totaled $1 a share, unchanged from 1935.

The largest cash distribution to stockholders last year was that by Standard Oil Co. (N. J.) of approximately $52,000,000, equal to $2 a share. It compared with a cash payment of $32,304,521 distributed in 1935, equal to $1.25 a share on capital stock. In addition, the company in 1935, paid out a dividend in capital stock of Mission Corp. having a value of $18,329,313.

Standard Oil Co. of Indiana made the second largest cash payments to common holders, of $36,517,625, equal to $2.40 a share, and more than double its outlay in the previous year of $15,142,372, equal to $1 a share. Socony-Vacuum Oil Co. ranked third, paying out $22,195,919, equal to $.70 a share against $9,345,442, equal to $.30 a share a year earlier. Standard Oil Co. of California disbursed $15,617,705, equal to $1.20 a share, versus $13,014,754, equal to $1 a share, and The Texas Corp. $14,010,104, equal to $1.50 a share against $9,339,861, equal to $1 a share in 1935.

Other companies which distributed more than $10,000,000 in cash dividends to junior stockholders were Consolidated Oil Corp. ($11,155,909 against $3,495,087); Phillips Petroleum Corp. ($10,678,092 versus $5,188,780); Humble Oil & Refining Co. ($13,478,493 versus $8,978,671). Consolidated Oil Corp., which in June last adopted a policy of quarterly payments by the declaration of 15 cents, equal to $.60 a year, on December 16, last, lifted the quarterly rate to 20 cents, equal to $.80 a year.

In spite of the payment of larger dividends last year, in some instances representing a major portion of earnings, the leading companies will show additions to their surplus accounts. These accounts, it will be recalled, faced heavy withdrawals in the difficult years of 1931 and 1932 incident to a downward revision in values of assets, including properties. Additions to surplus accounts for 1936, in the aggregate, probably will top those for 1935, which was an outstanding year in this respect.

Refunding operations by seven companies last year, representing largely the conversion of high interest into lower rate obligations, will save these companies net of approximately $2,000,000 in annual fixed charges. The refundings, for the most part, were detailed in the July issue of WORLD PETROLEUM.

They included the sale of $85,000,000 debentures by Standard Oil Co. (N. J.) to retire preferred stock of Standard Oil Export Corp., which subsequently was dissolved; $60,000,000 each of debentures by The Texas Corp. and Shell Union Oil Corp.; $50,000,000 by Consolidated Oil Corp.; $14,000,000 of preferred stock by Atlantic Refining Co.; an aggregate of $12,000,000 serial notes and debentures by Skelly Oil Co., and 296,631 shares of additional common stock by Phillips Petroleum Co. to provide funds for the repayment of bank and private loans, as well as a serial maturity of notes, totaling in all $5,900,000. Phillips, because of the financing operation, now has only $12,000,000 of serial notes outstanding, the first maturity being December 1, 1940.

Just recently Union Oil of California issued a call for redemption of its $7,500,000 of 4 percent convertible debentures. To retire the issue, Union is offering a new $10,000,000 issue of 3½ percent debentures. The excess above $7,500,000 will be used for corporate purposes and also to anticipate the maturity next May of $1,200,000 of 3¼ percent serial notes.

Other developments of a financial nature in the American petroleum industry last year included the acquisition by Tide Water Associated Oil Co., for common shares, of the capital stock of Terrabella Investment Co., a California holding company owning producing and non-producing acreage in two counties of California, part in the Kettleman Hills. Tide Water Associated, in addition, acquired 172,743 shares of the capital stock of South Penn Oil Co., (about a 15 percent interest).

To simplify its corporate structure, Tide Water Associated, merged its two subsidiaries Tide Water Oil Co. and Associated Oil Co. into the parent company. The merger will result in tax savings which, otherwise, would be imposed under the Revenue Act of 1936.

Standard Oil Co. (N. J.) also made progress in simplifying its corporate status by dissolving and liquidating one of its holding company subsidiaries, Pan American Foreign Corp., which was 99.33 percent owned by it. The latter held a majority ownership in operating companies in Venezuela and Mexico, as well as tankers, which were acquired several years ago from Standard Oil Co. of Indiana. This move, like that in the case of Tide Water Associated Oil, was undertaken to avoid the payment of duplicate taxes.

During the year Standard Oil Co. (N. J.) also offered an exchange of its shares for minority holdings in Colonial Beacon Oil Co., and through this offer, it was instrumental in acquiring 99.48 percent of the total issued stock of Colonial Beacon. It is probable that the latter, at some time in the future, will be merged into one of the other companies of Standard.

Another outstanding development during 1936, which in future years should prove mutually profitable for Standard Oil Co. of California and The Texas Corp. is the formation of California Texas Oil Co. To the new company, jointly owned by Standard of California and Texas, crude will be furnished from the Bahrein Island reserves of the California company while The Texas Corp.,

through subsidiaries, will furnish sales outlets east of Suez, including Africa.

The joint acquisition by Socony-Vacuum and The Texas Corp. early in 1936 of 79 percent of the Barco concession in Colombia, South America, from the Gulf Oil interests, should benefit the two companies in later years. It is planned to develop the Colombian property and to install a pipe line system to seaboard, and possibly a refinery, to utilize the crude for refined products to markets outside the United States. Besides obtaining the benefit of lower costs in Colombia, making possible more effective competition on the international market, the two companies also will conserve their American oil reserves for the domestic market.

From a strictly financial viewpoint, Socony-Vacuum Oil in 1936, changed its method of accounting with respect to intangible development costs, principally drilling expenses, by capitalizing and amortizing them over a period of years. Heretofore it charged such expenses directly to current operating costs. The net result of the change will be reflected in higher income in reports to stockholders.

Although leading companies outside the United States do not publish interim reports of their operations, it is understood that their financial results have shown gains but not commensurate with those by American companies. An exception to this general trend may be noted in a few rare instances.

Royal Dutch Co. (N. V. Kloninklijke Nederlandsche Maatschappij) is an example. It will show an important addition to its income by receipt of a dividend on its common holdings of Shell Union Oil Corp. These holdings, it is understood, approximate 64 percent of Shell Union's outstanding shares, or some 8,365,000, so that Royal Dutch's share of that dividend aggregates slightly more than $2,000,000.

A short while ago the directors of Royal Dutch postponed consideration of an interim dividend until after the year-end. From Amsterdam it is rumored that a 10 percent interim payment is possible. Royal Dutch has not paid an interim dividend since 1934.

Shell Transport & Trading Co. directors recently declared an interim dividend of 7½ percent and a bonus of one share in five.

That operations for Imperial Oil, Ltd. were conducted on a better basis in the past year is indicated by the report of International Petroleum Co., which Imperial controls. In the year ended June 30, 1936, International reported net income of $24,023,757, after all charges, equal to $1.65 a share on the combined 200,000 shares (par $2.50) of preferred and 14,324,088 no par shares of common stock. It compared with $21,666,535, or $1.49 a share on combined preferred and common stocks in the preceding year.

The impressive gains by the world's leading petroleum companies for the last six years are detailed in the accompanying tabulation which shows, where reports have been issued, net income, per share earnings, net working capital, net capital assets (property, plant and equipment after reserves for depreciation and depletion), funded and/or long term debts, shares outstanding and surplus accounts.

# INCREASED BRITISH EARNINGS

## Anticipated for 1937

IGNORING numerous disappointing dividend announcements during the fourth quarter of the year, oil share prices on the London Stock Exchange have finished 1936 at around the year's highest levels. Share market strength reflects a widespread conviction among the British investing public that, notwithstanding interim dividend disappointments, oil company earnings will show a satisfactory increase for 1936 over the previous twelve months. Consideration of the factors governing oil company earnings certainly suggests that this optimism has some justification.

Operations of British-owned oil enterprises are so widespread and diversified as between one company and another that no definite profit-assessing rule can be laid down for all. Two of the main influences, however, are the American price structure, and distributing conditions in the United Kingdom.

No one pretends that the British market for oil products is as remunerative as it should be. Competition remains keen, and regarded superficially, an increase in the turnover of oil distributors has been largely offset during the past year by smaller profit margins. This aspect of oil company experience is made clear in the following comparison of statistics relating to the first nine months of the year.

| | Period January–September | |
|---|---|---|
| | 1935 | 1936 |
| Total imports (bbl.) | 61,939,913 | 63,416,285 |
| Customs releases of all refined products (bbl.) | 41,574,394 | 43,681,637 |
| Average C.I.F. import value of refined products (per gallon) | 3.03 d. | 3.28 d. |
| Average C.I.F. import value of crude | 2.05 d. | 1.98 d. |

Both the import and customs release statistics bespeak rising consumption, but the record of C.I.F. prices is unfavourable to distributors when put against the fact that quoted prices for the great majority of oil products have remained unchanged as compared with those ruling in 1935.

Prices for motor spirit were last moved on May 1, 1935, when a general rise of 1 d. per gallon became effective. As a result, the average price of first grade spirit for 1936 was 18 d. per gallon, compared with 17.67 d. in the preceding year, thereby giving importers a slightly increased apparent margin. Commercial grades of spirit were also quoted 2 d. higher on May 1, 1935, but a very large proportion of these grades is sold under contract at prices below quoted figures. It is believed, nevertheless, that contract spirit prices were on a better basis in 1936 than in the preceding year. Although quotations for other products have remained unaltered, prices at which business has actually been done have probably been at least as favourable in 1936 as in 1935, even allowing for the rise in C.I.F. costs. Margins should also have been improved by the small decline from 2.05 d. to 1.98 d. in the C.I.F. price of crude, although crude accounts for something less than 20 percent of total imports of petroleum into the United Kingdom.

In assessing the profits of most companies importing into this market, however, C.I.F. values have little or no significance. The great majority of these concerns are selling oil produced on their own property, or by subsidiary concerns. For several independent concerns and the big integrated groups, profits are therefore merely a question of production, refining, transport and distributing costs subtracted from selling prices. Wherever such profits arise, and however they are adjusted as between one member of the group and another, they accrue in the long run to the parent undertaking either directly or through associated concerns.

With undertakings of this integrated type, C.I.F. values are merely cyphers, and may be largely ignored in estimating the financial

experience of the producer-distributor companies and groups handling the great majority of British oil consumption.

If it can be assumed that profit margins during 1936 were as good all 'round as in the previous year, most companies operating in Britain should have improved their profit earning position. Judging from the customs release statistics, consumption increased during the first three-quarters of 1936 by five percent as compared with 1935. Not only does this expansion of turnover represent so much more direct profit, but it also has a favourable effect on overall profit margins by enabling much plant and personnel to operate nearer to capacity.

Aside from the economy naturally associated with a larger turnover, many cuts in distribution costs were achieved by British companies and groups in 1935. These should have become fully effective during the past year, to the additional benefit of the companies concerned. There is thus good ground for the assumption that net profit margins in Britain have increased, even when due allowance is made for the large expenditure on plant improvement and on research which the year's revenues may have had to bear.

British oil undertakings selling their output on the basis of dollar prices should also have improved their earnings on balance. They have had the advantage of the rise in United States quotations at the beginning of 1936 and from the general strengthening of the American price structure. The price factor should have more than offset the slightly less favourable average level of the London-New York exchange, which has given oil undertakings a smaller amount of sterling for proceeds of dollars than they received in 1935.

In India, as in many other distributing markets, conditions have shown little or no improvement in 1936. These outlets, however, are not of first importance except to Burmah and a few less important concerns selling in India or Europe. Taking British companies as a whole, 1936 should have marked a further recovery in earnings from the main centres of operation.

Viewed from the angle of present conditions, the outlook for 1937 is equally encouraging. The improvement in the statistical position in the United States is already being reflected in prices, and there is no sign of a set-back to British internal trade activity. Petroleum companies should also derive some advantage from the exchange stability and from any relaxation of trade barriers which may result from the new currency arrangements between the United States, Great Britain and France. Other countries, including Holland and Switzerland, have already announced their adherence to this agreement, and the tendency seems definitely in the direction of greater rather than less freedom for international trade. Wider international intercourse will benefit oil companies, and the outlook for British oil companies certainly seems more promising than for some years past.

# OIL EQUIPMENT COMPANIES

## Fared Well Financially in 1936

THE oil equipment companies, sharing in the prosperity enjoyed by the petroleum industry, on the whole closed 1936 with net profits at the best levels in seven years. In addition those companies which had dividend arrears on preferred stocks, incurred during the depression when operations were in the red, were able either to pay off these accumulations entirely or to make a distribution against them. Others disbursed dividends on common stocks for the first time in many years.

The betterment in operating conditions was also reflected in an improvement in financial status as expressed in terms of additions to surplus accounts. In many instances these accounts were drawn on heavily during depression years, particularly in 1931, 1932 and 1933, to finance deficit operations. Moreover, companies which had funded or long-term debts made progress in recent years in reducing those obligations through the sale of additional common stock or as the result of the restoration of profitable operations.

Recoveries in profits of the equipment companies, based on operations of five whose shares are listed on the country's leading exchanges and for which complete figures are available, were even more pronounced than in the oil industry itself. For all of 1936, the equipment companies, taken as a whole, will register a gain of more than 200 percent in profits over 1935. For the oil industry the gain in profits over the same time will average about 60 percent.

In the first nine months of 1936 four of these companies (the fifth does not publish interim accounts) showed an increase in profits of more than 190 percent compared with the full year 1935.

How marked has been the reversal of the operating status of these companies in 1936 against early years of the depression is best evidenced by the fact that they showed aggregate deficits in 1933, 1932 and 1931 ranging from $2,507,649 to $5,270,864.

While it is difficult to forecast for all of 1937, there are indications that the equipment companies should even better the profits attained in the year just closed. There are several reasons for optimism. The oil companies themselves plan for another record year on production and demand ranging from 7 percent to 9 percent larger than for 1935. This means that drilling operations will continue on a large scale.

Furthermore, many large companies are planning to make additions to, and to improve, their refinery facilities which will result in a demand for equipment from companies in that field. Some opinion is that expenditures for improving refinery equipment will be the largest in several years.

Of the five companies whose shares are listed on exchanges, National Supply Co. and Bridgeport Machinery Co., in 1936, took steps either to clear or pay off part of the accumulations on their preferred stock.

The arrearage of dividends on the slightly more than 166,000 shares of National Supply preferred on October 1, 1936, amounted to $35 a share, and the directors, early in December, authorized a payment of $3.50 against that accumulation. About a month previously—November 6—the stockholders had approved a plan of recapitalization which would have provided for elimination of all arrearage on the preferred by issuance of new preferred and some common stock.

This plan was withdrawn, however, because of a subsequent legal decision rendered by the Supreme Court of Delaware (under whose laws National Supply is incorporated) in a recapitalization plan of another company, and National Supply could not be certain of the validity of its plan.

For 1936 it is probable that National Supply's net income will exceed $4,000,000, which would be the best showing in a decade. That profit would be equal to about $7.50 a share on the company's outstanding common stock, and compare with actually reported net of $670,620 for 1935, equal to $4.03 a share on preferred stock. For 1929 the company's net profits totaled $3,715,974.

# FIVE-YEAR REVIEW—Oil Equipment Companies

| Natl. Supply Co. | Gross Income | Net Income | A Share on Common | Net Current Assets | Net Capital Assets | Funded and/or Long Term Debt | Preferred Shares | Common Shares | Surplus |
|---|---|---|---|---|---|---|---|---|---|
| *1936 | $9,869,268 | $2,881,843 | $5.25 | $29,129,698 | $25,330,182 | $6,294,000 | 166,353 | 382,788 | $12,030,850 |
| 1935 | 8,467,228 | 670,620 | (a) | 26,887,475 | 25,320,702 | 6,294,000 | 166,221 | 382,656 | 9,681,274 |
| 1934 | 7,199,744 | (d) 121,486 | ..... | 27,458,270 | 24,724,518 | 7,000,000 | 166,215 | 382,650 | 8,912,981 |
| 1933 | 3,129,427 | (d) 2,815,960 | ..... | 26,364,979 | 25,411,916 | 7,437,000 | 166,156 | 382,591 | 8,581,341 |
| 1932 | 2,215,832 | (d) 3,847,638 | ..... | 28,590,325 | 27,938,355 | 8,132,000 | 166,156 | 382,591 | 6,467,973 |
| 1931 | 2,879,934 | (d) 4,495,797 | ..... | 33,151,432 | 29,049,756 | 8,336,000 | 167,996 | 391,353 | 10,500,893 |
| **Bridgeport Machine Co.** | | | | | | | | | |
| *1936 | +3,402,723 | 349,581 | 1.24 | 2,631,818 | 644,405 | ..... | 4,993 | 260,000 | ..... |
| 1935 | +2,538,490 | 139,871 | .70 | 1,059,117 | 394,411 | 62,400 | 5,019 | 150,000 | 779,654 |
| 1934 | +1,899,614 | 221,907 | 1.25 | 1,095,925 | 301,704 | 111,900 | 5,019 | 149,710 | 688,413 |
| 1933 | +1,095,122 | 50,414 | .10 | 978,209 | 195,890 | 167,400 | 5,019 | 150,000 | 506,652 |
| 1932 | +1,004,100 | 44,744 | .05 | 1,032,495 | 213,129 | 233,900 | 5,239 | 149,500 | 466,494 |
| 1931 | +1,072,407 | (d) 193,915 | ..... | 1,065,134 | 245,506 | 284,400 | 5,239 | 150,000 | (h) 589,596 |
| **Byron Jackson Co.** | | | | | | | | | |
| *1936 | ..... | (b) 974,682 | 2.71 | 2,350,235 | ..... | 381,000 | ..... | 359,680 | ..... |
| 1935 | (c) 1,026,341 | 456,142 | 1.31 | 1,178,925 | 1,239,090 | 941,000 | ..... | 347,480 | 617,387 |
| 1934 | (c) 735,549 | 317,391 | .92 | 1,811,834 | 1,269,439 | 1,758,000 | ..... | 346,356 | 473,378 |
| 1933 | (c) 399,092 | 35,445 | .10 | 1,706,767 | 1,419,224 | 1,998,500 | ..... | 347,708 | 286,378 |
| 1932 | (c) 177,986 | (d) 219,606 | ..... | 1,666,690 | 1,521,047 | 2,159,000 | ..... | 347,208 | 325,933 |
| 1931 | (c) 377,092 | (d) 293,086 | ..... | 2,071,215 | 1,649,229 | 2,528,500 | ..... | 346,708 | 539,813 |
| **Reed Roller Bit Co.** | | | | | | | | | |
| *1936 | ..... | (e) 1,455,010 | 2.31 | (f) 2,036,204 | (f) 3,515,174 | ..... | ..... | 598,950 | 4,429,186 |
| 1935 | (g) 1,899,283 | 695,746 | 3.52 | 1,796,308 | 3,238,545 | ..... | ..... | 197,750 | (h) 5,054,720 |
| 1934 | (g) 1,725,414 | 651,264 | 3.29 | 1,623,337 | 3,641,180 | ..... | ..... | 197,750 | (h) 5,272,636 |
| 1933 | (g) 1,791,629 | 222,352 | 1.12 | 1,501,848 | 3,967,030 | ..... | ..... | 197,892 | 1,520,132 |
| 1932 | (g) 1,467,624 | 234,964 | 1.17 | 1,425,258 | 4,456,314 | ..... | ..... | 200,545 | 1,400,995 |
| 1931 | (g) 1,704,640 | 186,068 | .92 | 1,647,410 | 4,984,420 | ..... | ..... | 201,840 | 1,659,432 |
| **Emsco Derrick & Equipment Co.** | | | | | | | | | |
| 1935 | (j) 4,178,703 | 571,306 | 1.53 | 2,377,021 | 1,227,460 | ..... | ..... | 373,594 | 2,108,113 |
| 1934 | (i)(j) 3,335,000 | 444,164 | 1.19 | 2,261,032 | 1,044,797 | ..... | ..... | 373,594 | 1,957,101 |
| 1933 | (j) 2,119,349 | (d) 2,546 | ..... | 1,785,428 | 1,097,897 | ..... | ..... | 377,194 | 1,506,038 |
| 1932 | (j) 1,690,398 | (d) 158,486 | ..... | 2,593,274 | 2,924,320 | ..... | ..... | 400,000 | 819,803 |
| 1931 | (j) 2,061,212 | (d) 474,153 | ..... | 3,115,122 | 3,010,410 | ..... | ..... | 400,000 | 1,002,523 |

(*) Nine months ended September 30.
(+) Net sales and rentals.
(a) Equal to $4.03 a share on preferred stock.
(b) Includes non-recurring profit of $322,388 from sale of an affiliate.
(c) Gross profit on sales.
(d) Deficit.
(e) Before federal taxes.
(f) As of June 30, 1936.
(g) Gross operating income.
(h) Capital stock and surplus as reported in those years.
(i) Approximate.
(j) Net sales.

Bridgeport Machine Co., by the sale of additional common stock early in 1936, was able to retire $250,000 bank loans, provide funds for drilling and to strengthen its working capital position. The company, it will be recalled, expanded its operations in 1933 to include the holding and operating of oil producing properties. Its drilling costs have been kept low because of its ability to purchase machinery cheaply.

Besides making full payment of the arrearage on its preferred stock last summer, Bridgeport Machine also distributed a dividend of $1 a share on its common stock in November. The latter represented the first payment on common stock since May 1, 1930, when 25 cents a share was disbursed.

Byron Jackson Co., a West Coast manufacturer of oil tools and equipment, made forward strides in liquidating its funded and/or long term debt in the past year. In the third quarter, alone, it acquired and cancelled $375,000 of the entire series A, B, C, D and E debentures. This left on September 30, last, only $381,000 of series F 4½ percent debentures outstanding. At the end of 1935 its debt amounted to $941,000, and a year previously to $1,758,000.

In line with increased earnings in 1936, and to avoid penalties imposed by the Revenue Act of 1936 with respect to undistributed profits, Byron Jackson Co. made several extra dividend payments to its capital stock holders. The last was for $1 a share payable in December, while in both October and July it distributed extras of 25 cents each in addition to quarterly payments of 25 cents each.

Similarly, Reed Roller Bit Co., to avoid tax penalties, made several extra dividend disbursements during the year aggregating in all $1.45 in addition to other interim payments amounting to 85 cents. The company, in April, 1936, sold 31,050 shares of additional common stock for about $711,000 which was used in general development and expansion of its business.

In March, 1936, Reed Roller Bit split its capital stock on a three-for-one basis, making the authorized capital 610,000 shares of no par value against 210,000 shares of no par value. As of September 30, last, there were outstanding 598,950 of the authorized shares.

Emsco Derrick & Equipment Co., the fifth company in the tabulation, does not issue interim reports. That its operations in 1936 scored a gain over the previous year is evident from the fact that it, like the others, provided for the payment of an extra dividend of 12½ cents a share in December, in addition to the regular quarterly of 25 cents.

In the tabulation above are listed the financial statistics of the five companies for the past five years, with nine months' figures for those companies which publish interim reports.

# CONSERVATION DEPARTMENT

## Proposed in Government Reorganization Plan

**Proposal may presage new federal control move—flood of bills affecting oil industry**

In his message to Congress recommending a reorganization of the administrative divisions of the federal government the President suggested changing the title of the Department of the Interior to Department of Conservation. The matter was mentioned almost incidentally and no elaboration was given as to whether the proposed change in title involved any extensive alteration in the functions of the Department.

To some of those in Washington, however, who are conversant with the plans and purposes of the Administration the proposed change seems particularly significant. They look upon it as a step toward a more determined effort than has been made heretofore to put the regulation of "natural resource" industries under the control of the federal authorities.

It is no secret that some of the closest advisers of the President are strongly—one might almost say violently—in favor of extending federal authority over industries of the class referred to, particularly oil, coal, gas and timber. Their argument is that such control is necessary to avoid the waste of important national resources and to conserve their supply for future use. Mr. Roosevelt himself adheres to this view but until now he has not exerted any strenuous effort to make it effective because of other urgent matters that demanded his attention. There is every reason to believe, however, that one of the important features in the program for the Presidential term now beginning is the establishment of a strong and permanent policy of conservation under federal authority, using the term "conservation" in the special sense that always applies to it in administration circles.

Whether actual regulatory legislation on a broad scale will be sought with administration backing at the present session of Congress is not known. The question probably has not been decided even in the innermost circle. Its answer may depend upon the reception of some trial balloons in the form of bills shortly to be put forward in one or both Houses of Congress. There is every reason to believe, however, that a real start is being made in a determined effort toward the centralization of nationalized authority over oil, gas and coal for purposes of both physical and economic conservation.

Promptly with the convening of Congress various bills that have failed to get across the legislative goal line in previous sessions made their appearance in more or less familiar form. One of these is HR88, introduced by Representative Morgan Sanders of Texas. In effect it would double the existing tariff on imported petroleum except the rate of 2½ cents per gallon on gasoline and four cents on lubricating oil. Should it be adopted crude oil would pay 42 cents per bbl. instead of 21 cents and fuel oil one cent a gallon instead of one-half cent. Imports of asphalt would pay $2 per ton. It also would settle the dispute as to whether imported fuel oil used in bunkering is subject to tax by striking out the phrase "fuel supplies" from the 1933 amendment to the revenue act of 1932 which is the portion of that law covering the taxation on petroleum.

In a case brought last year before the U. S. Customs Court it was held that imported fuel oil supplied to ships of foreign registry in American ports was subject to taxation. That decision was reversed subsequently and the ruling was made that all vessels were exempt from taxation on their bunkering supplies. Representative Sanders proposed to remove this exemption in the case of foreign owned commercial ships despite the objection that it will tend to transfer the bunkering business to foreign ports.

It will be remembered that the impost on petroleum is not officially classed as a tariff but is called an excise tax. Since it applies only to imports, however, it has all the appearance and effect of a tariff except the name. It is noteworthy that the bill of Representative Sanders differs from its predecessors dealing with this subject in that it does not attempt to limit imports to any stated ratio of the domestic supply or total demand. This does not mean, however, that there will be no attempt to place such a limitation upon imports. It is understood that a bill covering this will be introduced separately. This separation is again attributed to the desire to avoid the charge of "tariff" while providing its actuality.

S1, to which attaches whatever honor may belong to the first bill introduced in the Senate, is now a coal bill introduced by Senator Guffey. Its importance to the petroleum industry is primarily in the proposal of the coal men to tax fuel oil one cent a gallon "to equalize competition." This is a measure that was sponsored by Representative Boland of Pennsylvania in the preceding session. From the coal producer's viewpoint it is expected to discourage the use of oil for domestic and industrial purposes and thereby maintain a larger consumption of coal. It is opposed not only by the oil industry but by consumers who prefer oil fuel because of greater convenience and cleanliness and do not see why they should be penalized for their preference.

First action by Congress was the hurried passage of a bill designed to stop impending shipments of airplanes and armament to Spain. It is probable that this measure may be revamped later in the session to broaden its scope and provide for a complete embargo on all war materials in which oil will be included.

The legislative grist is only beginning and bills covering almost every conceivable purpose—and some that appear inconceivable to all except the authors—are being dumped into the hoppers daily. Among these are a considerable number that will have a direct or indirect bearing upon the oil industry. Many of course will never be heard of again. The fate of others will depend upon the energy with which they are pushed and the backing which their originators are able to obtain.

A large number of bills providing for additional labor legislation or amending existing acts have been introduced and many more will follow. It is no secret that the labor lobbyists are disappointed in the results of the Walsh-Healey law establishing standards of hours and wages for concerns handling government contracts. They want to extend its requirements to indirect as well as direct suppliers and hope to include provisions which will force all government orders to go to unionized plants. Then there is the 30-hour week proposal to which all unionized labor is pledged. Until the judicial fate of existing labor acts is known the attempt to frame legislation on this subject may be deferred. At the present time of course the whole labor situation is in such confusion as a result of the drive of John L. Lewis's C.I.O. forces against General Motors that it is impossible to foresee what course Congressional activities in relation to labor questions may take.

Other bills which are time honored veterans of preceding Congresses are due to reappear. Among these are the proposal to separate pipe lines from oil company ownership, projects for more strict control of commercial motor trucks and bills for the regulation of tankers and other water carriers. Pipe line segregation has the aggressive backing of the National Oil Marketers' Association.

Representative Wright Patman has been formulating a follow-up to the Robinson-

Patman law in a bill to prohibit manufacturers engaging in the retail sale of their products. This would put an end to oil company ownership of service stations, but as the companies are moving as rapidly as possible to divest themselves of these outlets it might not prove embarrassing to them. Washington observers will wait to see whether Senator Robinson introduces the bill in the Senate before guessing as to its chances of adoption. If he does introduce it the assumption will be that the White House is actively or passively in sympathy with it.

Of bills pertaining directly and exclusively to petroleum it is generally accepted that the Conally act prohibiting interstate transportation of "hot" oil will be extended for a period of at least two years from its expiration next June. Renewed authorization of an interstate oil compact, probably for a like period, is taken for granted. There appears to be no serious opposition in Congress to either of these measures. The two-year feature reflects the views of the Texas leaders and Texas has a habit of getting its way in petroleum legislation.

Utilizing an appropriation made last year the United States Bureau of Mines is now engaged in making an exact survey of crude oil stocks in the country. A bill introduced by Representative Dempsey of New Mexico would appropriate $15,000 a year for the specific purpose of keeping this survey up to date. In this connection it may be noted that the National Oil Marketers' Association is demanding that Congress prohibit the Bureau of Mines from issuing its monthly forecasts of probable market demand for crude oil and petroleum products on the ground that these are an "aid to monopoly" by encouraging the limitation of production. The association is against extension of the Conally act and the interstate compact on the same grounds.

Whether or not an attempt will be made at this session to apply to the oil industry broad regulatory legislation of the type proposed two years ago remains an open question. Secretary of the Interior Ickes, who is looked upon as the leading proponent of federal control, thus far has denied consistently that he contemplates any move in this direction. At the same time it is generally understood that drafts of bills greatly broadening the scope of federal authority over oil and gas are still in the files of his department and could be made to fit existing conditions with very slight revision.

As indicated at the beginning of this report the best guess probably is that the former Petroleum Administrator and those who think as he does will defer any further move until they see what befalls the President's reorganization plan. Should Secretary Ickes become the head of a new Department of Conservation specifically charged with husbanding the natural resources of the country he would be in a stronger position to demand authority for the prevention of physical or economic waste.

Senator Thomas of Oklahoma, who follows the oil situation closely, has expressed himself as believing that the wisest course for Congress to take would be to reenact the Conally law, the interstate compact authorization and the existing tariff law and avoid other special legislation. His view is that oil producers are doing well, that the market situation is reasonably stable and that as the industry is going along smoothly there is no reason to disturb it.

In the House, Representative Rayburn, as chairman of the important Interstate Commerce Committee, heretofore has been able to exercise a high degree of influence in promoting or sidetracking bills affecting the oil industry. With his advancement to the position of majority floor leader he will be in a position of perhaps greater authority in determining what bills shall come up for action and what shall not, but he may feel greater restraint in opposing or disregarding the wishes of the Administration.

At any rate, when questioned on the subject of possible legislation, Mr. Rayburn said in substance that he felt he should wait and see what bills were put forward before expressing his views. Translated from the language of political Washington this may be interpreted to mean that he will wait and see whether the President desires to have some particular bills enacted before placing himself out on a limb. If the President shows no urgent desire for oil legislation Leader Rayburn, as in the past, will act in accordance with his interpretation of the wishes of his Texas constituents. If the President brings forward a specific program Mr. Rayburn may be embarrassed but probably will go along.

Representative Rayburn's elevation to the post of House floor leadership brings Representative Lea of California to the chairmanship of the Interstate Commerce Committee. Representative Lea is an ardent New Deal follower and may be expected to press for action his former bill for appointment of a research commission to study and promote the use of synthetic motor fuels including alcohol from renewable sources, meaning from farm crops. The California representative also favors a broader degree of federal control over natural resource industries and introduced last year a bill for the regulation of gas transportation through interstate pipe lines.

Until the Administration's program is more fully defined it will be impossible to evaluate accurately the prospects of specific legislation affecting the petroleum industry. The wide variety of proposals that are being hopefully put forward suggests, however, that there will be substantial reason for members of the oil industry to keep their eyes on Washington during the months to come. At least they are not being overlooked on Capitol Hill.

Outside of legislative circles it is interesting to note that the Federal Trade Commission is at last showing evidence of activity in various matters affecting oil. One of these is the gasoline pump code. Another is the proposed petroleum marketing code which has now been before the Commission for several months.

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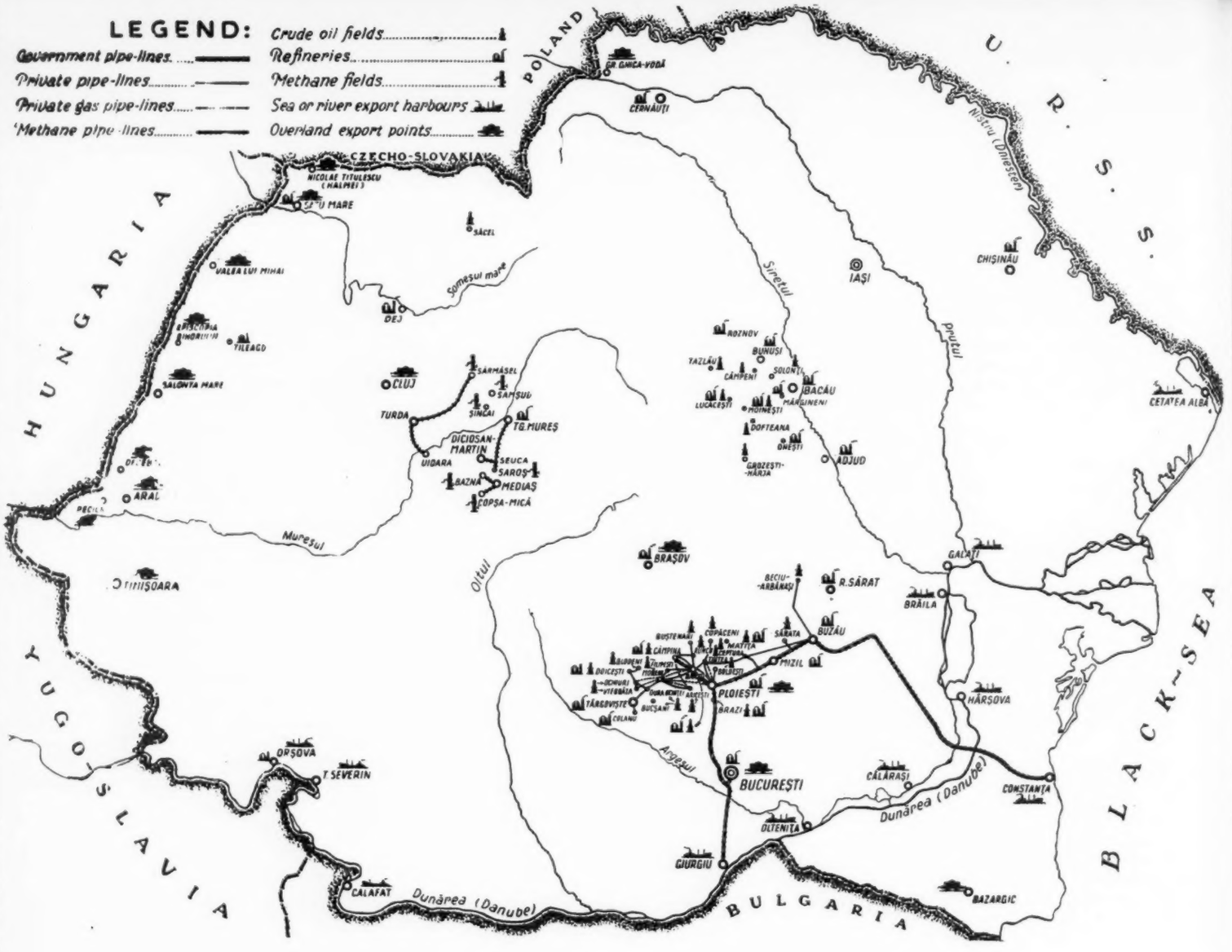



# ROUMANIAN EXPORTERS PAY HUGE PREMIUM

ALTHOUGH Roumania preceded other countries of the world in the exploitation of oil, efficient and modern methods of oil transportation are still lacking. The underlying reason for this apparently paradoxical situation is not difficult to explain. The railroads are state-controlled—and the state has no desire to lose the prolific source of revenue provided by its monopoly on the transportation of crude and gasoline.

Sporadic attempts have been made by Roumanian oil companies since 1912 to have a pipeline built from Baicoi to Constantza, but something always has happened to prevent it. As a result, Roumanian oil companies today pay about 1.70 lei per ton-kilometer to ship gasoline by tank-car, while companies in other export countries pay only 0.18 lei per ton-kilometer by pipeline—almost one-tenth the Roumanian figure.

Roumania today exports roughly 2,000,000 tons of gasoline annually. Under present conditions, this gasoline is shipped to Constantza on the Black Sea by railway, the oil companies paying the railway (i.e., the state) about 430 lei per ton.

Let us assume that the pipeline from Baicoi to Constantza were built, and that 60 percent (approximately 1,200,000 tons) of Roumania's gasoline exports were shipped through it to the sea-coast, and the remaining 40 percent (approximately 800,000 tons) continued to be shipped via railway. On this basis the estimated figures in the accompanying Table I indicate that the state could afford to cut transportation charges in half (i.e., to 215 lei per ton) and still make a handsome profit of 73.4 lei per ton! Furthermore, it will be noted that the cost to the state of shipping gasoline by pipeline is only 107.5 lei per ton, as compared to 192.8 lei per ton by railway.

Crude petroleum at shallow depths has been known in Roumania for a considerable time, and until several decades ago crude oil, oxidized in the presence of air, was impartially used either for medicinal purposes or for greasing cart-wheels. In certain regions of Prahova, Bacau, Buzau and Dambovitza

districts, Roumanian peasants had wide renown as skilled well-drillers. With the help of teams of horses, they extracted crude oil from depths varying between 30 and 260 meters (100–850 ft.), selling it in barrels for fuel and other uses. Some oil was even exported, official records of 1825 mentioning shipments through Giurgiu, which is today still an important shipping point on the Danube River for oil exports destined for Danubian countries.

The first *metal* pipeline for transportation purposes was built in the United States in 1862, but it must be pointed out that bamboo pipes, lacquered inside, had been used as a means of transportation in certain regions of India for some years previously.

Roumania's first pipeline was built in 1891. It was about nine kilometers (5½ miles) long, and during the subsequent years its total length has been extended as outlined

**Roumanian Pipeline Development**

| Year | Total Length (kilometers) |
|---|---|
| 1906 | 515 |
| 1908 | 761 |
| 1912 | 1,282 |
| 1914 | 1,314 |
| 1928 | 2,320* |
| 1931 | 2,860* |
| 1935 | 3,360* |

* Including 760 kilometers (472 miles) of State-owned pipeline.

in the accompanying table. These figures include also pipelines connecting wells with each other, wells to refineries, and secondary lines from wells to tank stations, etc. The figures for the post-war years include, in addition to those used for crude oil, pipelines for the transportation of gas and natural gasoline.

Products shipped through the privately-owned pipelines fall into three categories: crude, gas and natural gasoline. During 1935 the proportion of various classes of privately-owned pipelines was: crude oil lines, 73 percent; gas lines, 12 percent, natural gasoline lines, 15 percent.

**Table I**

**Estimated Annual Income, Expense, Profit of Projected Baicoi-Constantza Gasoline Pipeline**

| | Expenses | Revenue |
|---|---|---|
| 1,200,000 tons by pipeline @ 215 lei per ton | | Lei: 258,000,000 |
| Amortization of capital and interest | Lei: 75,000,000 | |
| Operation and maintenance | Lei: 25,000,000 | |
| Replacement and contingent fund | Lei: 29,000,000 | |
| | Lei: 129,000,000 | |
| 800,000 tons by railway @ 215 lei per ton | | Lei: 172,000,000 |
| Material, maintenance, traction and quota of general expenses of Roumania Railways at 0.75 lei per ton/kilometer | Lei: 154,200,000 | |
| | Lei: 283,200,000 | Lei: 430,000,000 |

Gross income = Lei: 430,000,000
Total expense = Lei: 283,200,000

Net profit = Lei: 146,800,000 or 73.4 lei per ton.

The State-owned pipelines are used for transporting kerosene from Baicoi to Constantza, transporting crude from Baicoi to the refineries located near the city of Bucharest, and for shipping artificial crude oil (kunstoil) to Giurgiu.

Ownership of Roumanian pipelines is as follows: Concordia, 20.5 percent; Steaua Romana, 18 percent; Astra Romana, 14 percent; Romano-Americana, 9.5 percent; Unirea, 12.5 percent; and State-owned, 25.5 percent.

The need for a pipeline to Constantza, the seaboard outlet of Roumania, was felt several years prior to the World War. Almost every group of German, British or American capitalists that became interested in the exploitation of Roumania's oil resources did not fail to put forth proposals, one more attractive than the other, for the construction of pipelines to the export points. A serious study of the situation began in 1905 but did not assume a concrete form until 1912. A survey made at that time by the general manager of the C.F.R. (Roumanian Railways) stressed the necessity of building a pipeline and said, in part: "The construction of the pipeline, by lowering costs of transportation, will help the Roumanian oil companies to meet competition and establish new outlets abroad. The sacrifice required from the Railways is justified by the development of this industry, which indirectly will also benefit the state."

After many delays, in March, 1912, the Roumanian Parliament finally passed a bill entitled "Law for the Building of Pipelines for the Transportation of Crude Oil and Kerosene from Baicoi to Constantza." The pipeline was designed for a flow of approximately 1,000,000 metric tons (7,000,000 bbl.) per annum. As a grade of 167 meters (548 ft.) existed between Baicoi and Ploiesti, a natural flow was planned for 22 km. (13½ miles) and the first pumping station was to be installed at Ploiesti. (See accompanying map.) If the Balkan and World Wars had not broken out in 1913 and 1914, the work started in 1912 would have been completed in 1915.

The German army of occupation took the pipes laid on the Constantza line and used them in the building of two pipelines to Giurgiu, whence oil products refined at Ploiesti were shipped via the Danube River to the countries of the Central Powers.

*Oil pumping station at Teleajen on the recently modernized crude pipeline.*

Towards the end of 1918 the Roumanian government again took up the question of the Constantza pipeline, planning to use any available second-hand tubes in good order and acquiring new equipment for the completion of the line, as well as the necessary pumping stations and tanks, up to Pallas-Constantza.

The management of the state pipelines was incorporated in the technical and commercial administration of the Railways. In 1926 negotiations were carried on between the state and the oil companies for the establishment of a combined company to build a gasoline pipeline to Constantza which was to be converted into a crude oil pipeline in case of need. This company, which was to be known as the "Large Pipelines Company", did not, however, come into being, in spite of the efforts of the oil companies who offered to supply the necessary capital. Later administrative autonomy was granted to the state pipelines in the form of a State Autonomous Office, the management being entrusted to a Board comprising delegates of the state, railways and the oil industry. During this period many improvements were made to existing lines through revision of routes, replacement of tubes, increased pumping and tank capacity, etc.

The National Supply Corp., Ltd. sent engineers to the site who, after a careful study of local conditions, estimated the cost of the new pipeline at $3,800,000 (376,237,624 lei) inclusive of all installations, pumps, tanks and equipment necessary for satisfactory operation. This sum was to be paid in six to eight installments. But the contract was not granted either to the above concern or to another which subsequently offered to do the work for a total sum of 500,000,000 to 700,000,000 lei. Thus a project of inestimable value to the oil industry and absolutely necessary for the efficient and economical transportation of gasoline did not materialize.

After the suppression of the Autonomous Office the management of the pipelines reverted to the Railways Administration where the problem of a new line is surely of no further interest. The prevailing conception of this administration seems to be that the

## Table II

### Growth of Roumanian Exports

| Year | Kerosene | | Gasoline | | Crude Oil | |
|---|---|---|---|---|---|---|
| | Tons | Index | Tons | Index | Tons | Index |
| 1913 | 428,098 | 55 | 241,726 | 30 | 26,873 | 18 |
| 1929 | 774,321 | *100* | 802,421 | *100* | 2,542 | 2 |
| 1930 | 941,704 | 122 | 1,119,469 | 140 | 69,362 | 47 |
| 1931 | 1,044,962 | 135 | 1,547,472 | 193 | 84,297 | 57 |
| 1932 | 920,891 | 119 | 1,639,228 | 204 | 146,882 | *100* |
| 1933 | 950,801 | 123 | 1,757,216 | 219 | 235,262 | 160 |
| 1934 | 1,085,424 | 140 | 1,957,690 | 244 | 274,092 | 187 |
| 1935 | 1,167,342 | 151 | 1,951,922 | 243 | 335,427 | 228 |

## Table III

### Kerosene Shipped to Constantza via Pipeline

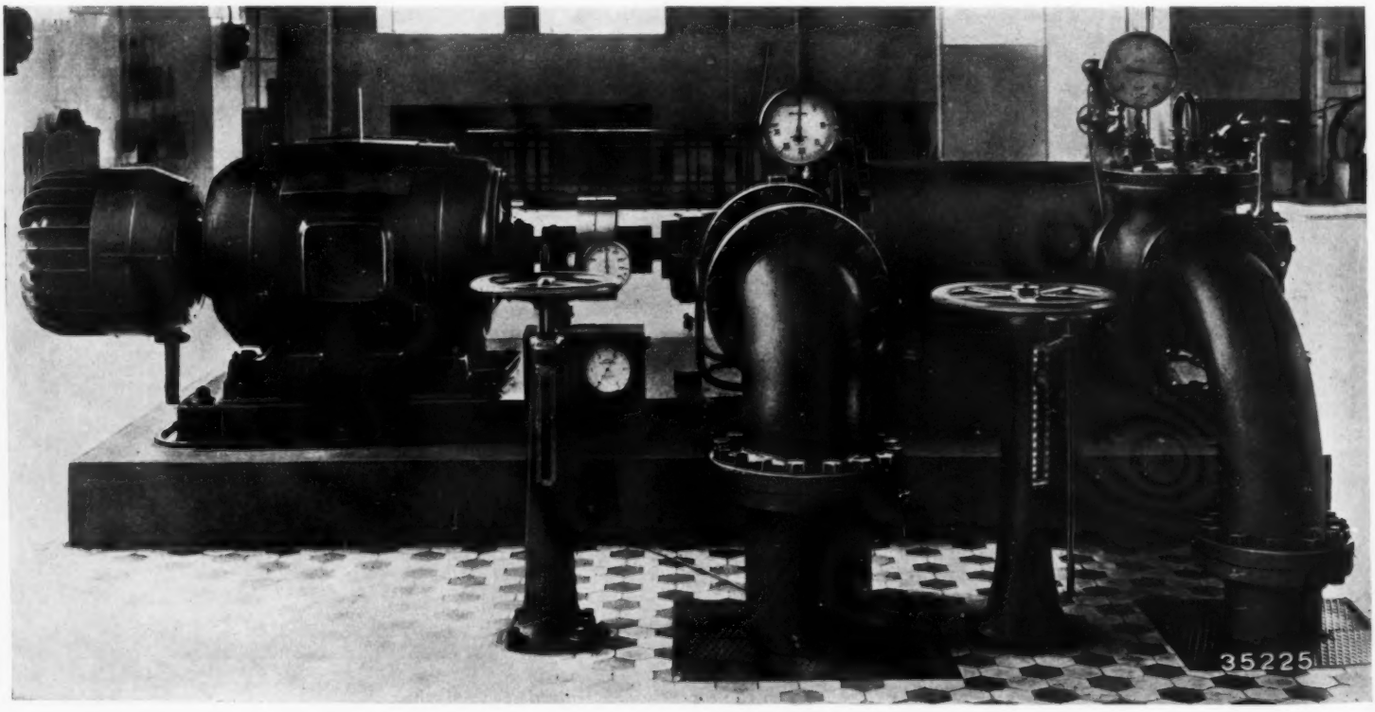
| Year | Tons | Index | Percent of total kerosene exported through Constantza |
|---|---|---|---|
| 1929 | 413,720 | *100* | 68.4 |
| 1930 | 527,850 | 128 | 69.8 |
| 1931 | 757,822 | 183 | 87.0 |
| 1932 | 671,111 | 162 | 87.0 |
| 1933 | 648,891 | 157 | 82.9 |
| 1934 | 792,938 | 192 | 89.6 |
| 1935 | 751,555 | 182 | 77.0 |

## Table IV

### Exports from Giurgiu

| Year | Total exports through Giurgiu (tons) | Index | Pipeline shipments to Giurgiu | Percent of total exports |
|---|---|---|---|---|
| 1919 | 438,999 | *100* | 89,340 | 20.4 |
| 1930 | 605,777 | 138 | 135,080 | 22.3 |
| 1931 | 527,618 | 120 | 117,474 | 22.3 |
| 1932 | 540,008 | 123 | 144,397 | 26.7 |
| 1933 | 716,388 | 163 | 217,438 | 30.4 |
| 1934 | 805,595 | 184 | 205,000 | 25.4 |
| 1935 | 877,053 | 200 | 238,983 | 27.2 |

*One of the centrifugal pumps manufactured by Sulzer on the Ploesti-Constantza pipeline.*



pipeline will enter into conflict with railway interests. This is a point of view so peculiar that if it were adopted in other countries a dead stop would be put to the immeasurable progress made by the oil industry throughout the world.

In the accompanying Table II comparative figures are given showing Roumanian exports of crude and products over a period of years. It can be clearly seen from these figures that up to 1935 gasoline exports have increased eight times over the 1913 figure, while kerosene exports have increased only 2½ times over the 1913 figure. Nevertheless, in spite of the relative importance of gasoline, only kerosene has been transported to the seacoast via the existing pipeline, all other products having been shipped by tank-cars on the railway.

The exact quantities of kerosene transported to Constantza through the pipeline are given in Table III.

Table IV gives the total exports of crude and products from the port of Giurgiu (on the Danube) during recent years and shows what part of these exports reached Giurgiu via the two pipelines, at present used for the transportation of artificial or natural crude.

The 760 kilometers (472 miles) of State-owned pipeline already referred to is divided by routes as follows:

Baicoi-Constantza; 320 km. (199 miles); for kerosene.

Baicoi-Giurgiu (with connections at Campina); two pipelines with a total length of 360 km. (223 miles); both used at present for black products.

Baicoi-Bucharest; 80 km. (50 miles); for crude oil.

## ADVANCE CONSTRUCTION PLANS

(Continued from page 29)

said to be considering the construction of a second plant at Big Springs, Texas, a cracking unit of 2,500 bbl. per day capacity. In Texas City, Texas the 18,000 bbl. per day plant being constructed by M. W. Kellogg for Pan American is expected to be completed toward the end of 1937. At Mount Pleasant, Texas the Talco refinery, 3,500 bbl. per day should start construction soon. This will probably be a Dubbs unit. Tyler Oil and Refining Company plan the construction of a cracking unit near Tyler, Texas. Ajax Oil and Refining Company are going to spend $200,000 on a 700 bbl. per day cracking plant early in 1937. Plans call for designing the plant so that capacity can be increased to 1,100 bbl. per day by the addition of a light oil furnace and a hot oil pump. Shamrock Oil and Gas Company are considering having a 2,500 bbl. per day cracking plant constructed to supply additional charging stock for their recently completed poly plant.

Socony-Vacuum are said to be planning a 9,000 bbl. per day cracking unit as part of their program for revamping existing equipment. Final decision in regard to this plant has been postponed until next July, however.

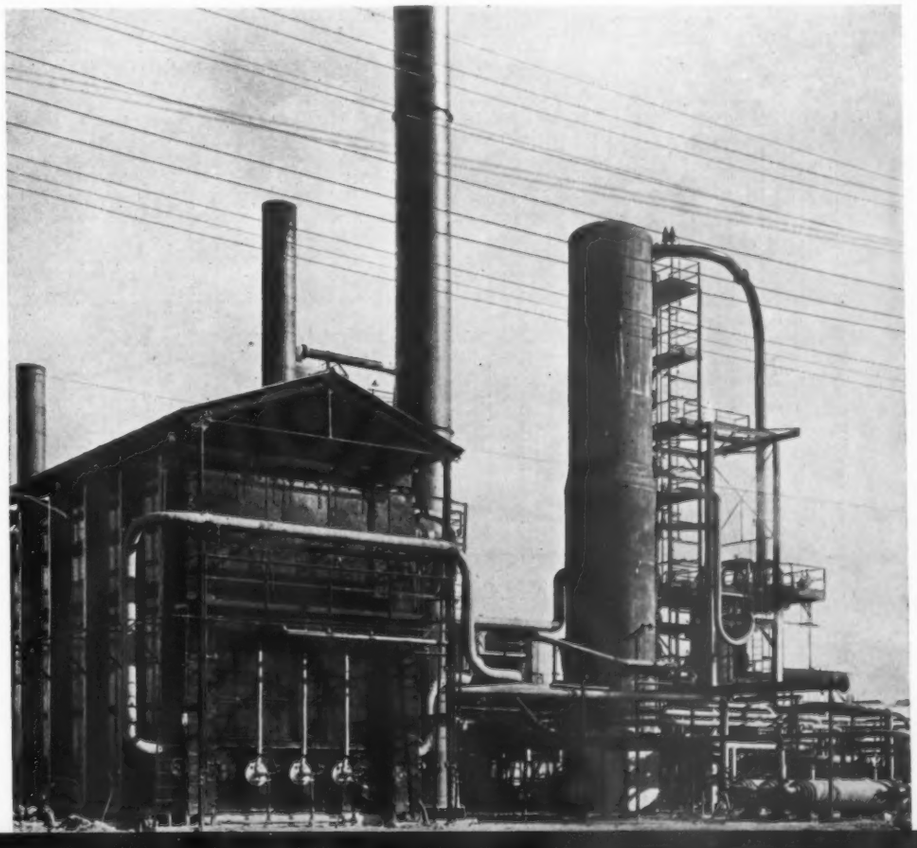
A number of plants will be constructed by companies whose names are not available for publication. One of these plants will be located in Ohio and will be a 5,000 bbl. per day combination unit. A large independent company is interested in constructing a 10,000 bbl. per day plant on the Gulf Coast and plans regarding this plant may be announced within a few weeks. Two combination units for construction on the Gulf Coast are also under consideration by two other companies. One of these plants would be a 10,000 bbl. per day refinery and the other, a 20,000 to 25,000 bbl. per day plant.

A small company will probably construct an 1,100 bbl. per day cracking unit in southern California and a local company marketing in Colorado contemplates construction of a 700 bbl. per day cracker, possibly a Dubbs unit.

In addition to these units, an important polymerization plant will be constructed at Baton Rouge and a Dubbs poly plant is now under construction at Lockport, Ill. for The Texas Company. Construction work on the latter is being carried on by The Texas Company. Shell Union plans to spend $375,000 on the construction of a unit that will be designed by Badger and will be located on the West Coast. The Southport Oil Corporation plans construction of refining facilities at the Long Lake field in Anderson County, Texas. Shell is now carrying on extensive modernization work at its East Chicago plant. National Refining Company may find it necessary to add to their capacity to handle new production to be developed in western Kansas. Another interesting report, in that it marks the return (perhaps temporary) of Winkler-Koch to the field of refinery construction, states that that company will build a $65,000 plant for Dryden and Associates in southwest Kansas to charge oil from the Shallow Water Oil Pool. Atlantic Refining have already completed several wells in that field and are engaged in drilling several more. Boyd-Frost interests are said to be planning a refinery for Anderson County, Texas.

The Jersey Standard's refinery construction program calls for plants at Baytown, Baton Rouge and Sarnia during the coming year. Tidewater is said to be considering the construction of an acetone benzol plant in the near future and the Standard Oil Company of California are working on plans for the addition of furfural and/or acetone benzol units. Definite plans for either or both of these plants have not been settled as yet. The units might be located at El Segundo or at Richmond. Malco Refineries, Inc. may add a clay treating system to their Artesia, New Mexico plant to treat about 500 bbl. per day of Dubbscracked gasoline to 30 plus color. Shell Petroleum Company have closed a contract with Alco Products for a propane recovery unit to be located at their Houston plant and to cost about $500,000.

While this list of refineries is, by its very nature, bound to be incomplete, it does help to indicate the direction that new construction will take over the course of the next year or year and a half. It should be understood that in many of the foregoing cases plans have not been completed and may be radically changed before contracts are finally let.



# World Oil Production—Official Figures for 1935 and 1936 Revised

**All figures furnished direct to WORLD PETROLEUM by governments, except where otherwise specified.**

**(Figures in U. S. Barrels—Conversion ratio 7 bb = 1.1 ton)**

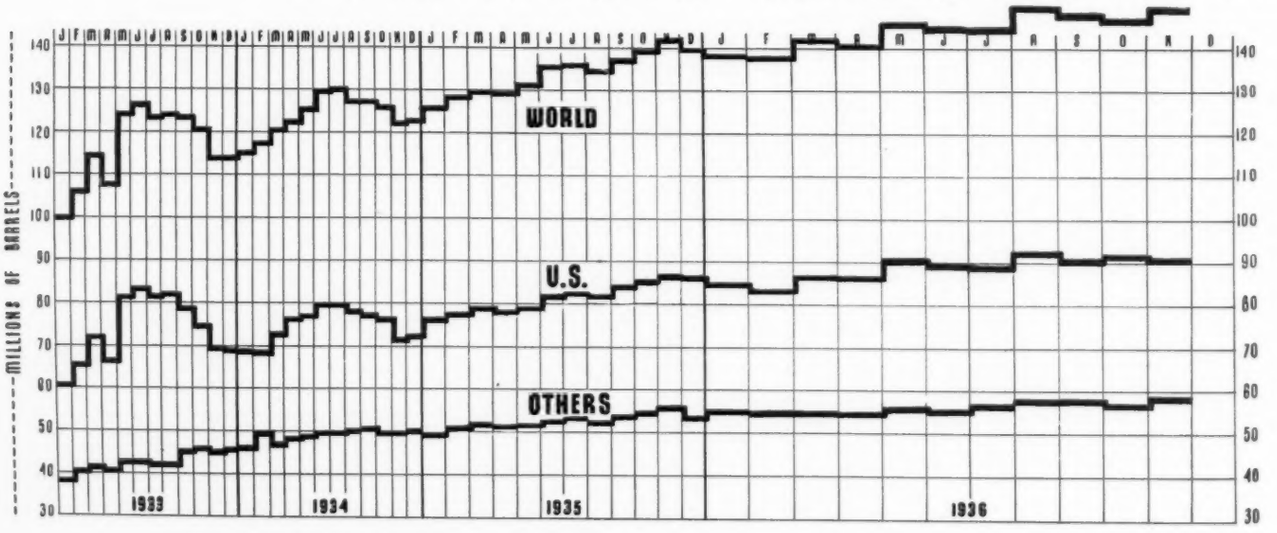
| Country | December 1935 | January 1936 | February 1936 | March 1936 | April 1936 | May 1936 | June 1936 | July 1936 | August 1936 | September 1936 | October 1936 | Provisional Figures November 1936 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| United States | 88,711,000 | 88,820,000 | 82,120,000 | 90,568,000 | 90,479,000 | 93,739,000 | 90,185,000 | 92,078,000 | 95,090,000 | 90,972,000 | 95,795,000 | 91,018,000 |
| Russia | 16,100,000 | 16,155,300 | 15,288,700 | 16,344,300 | 15,589,000 | 16,454,200 | 15,955,100 | 16,231,600 | 15,600,000[1] | 15,400,000 | 16,800,000 | 16,700,000 |
| Venezuela | 13,389,789 | 13,487,089 | 12,849,480 | 13,432,671 | 13,442,870 | 13,732,933 | 12,486,600 | 14,566,510 | 14,632,737 | 14,626,073 | 13,888,287 | 14,307,650 |
| Roumania | 5,361,000 | 5,242,000 | 4,809,000 | 5,209,000 | 5,226,000 | 5,568,000 | 5,563,000 | 5,606,000 | 5,585,000 | 5,254,000 | 5,224,000 | 4,982,000 |
| Iran[2] | 4,816,000 | 4,627,000 | 4,480,000 | 4,641,000 | 4,312,000 | 5,376,000 | 5,061,000 | 4,872,000 | 5,117,000 | 4,487,000 | 4,704,000 | 4,800,000 |
| Netherland India | 3,612,056 | 3,614,436 | 3,407,194 | 3,670,877 | 3,532,375 | 3,721,613 | 3,549,417 | 3,725,491 | 3,715,887 | 3,731,973 | 4,059,426 | 4,139,954 |
| Mexico | 3,666,265 | 3,377,302 | 3,285,965 | 3,542,088 | 2,997,883 | 3,235,255 | 3,167,300 | 3,179,614 | 3,773,503 | 3,768,855 | 3,235,224 | 3,204,007 |
| Iraq | 2,240,819 | 2,327,332 | 2,107,210 | 2,515,345 | 2,048,053 | 2,467,136 | 2,473,660 | 2,440,669 | 2,479,428 | 1,881,782 | 2,097,564 | 2,214,954 |
| Colombia[3] | 1,004,474 | 1,611,618 | 1,475,403 | 1,619,620 | 1,427,193 | 1,598,544 | 1,529,901 | 1,585,345 | 1,553,606 | 1,575,273 | 1,600,288 | 1,575,000 |
| Peru[4] | 1,381,031 | 1,377,006 | 1,293,627 | 1,351,810 | 1,403,626 | 1,500,485 | 1,452,306 | 1,524,303 | 1,527,072 | 1,478,482 | 1,507,433 | 1,445,605 |
| Argentina | 1,304,554 | 1,310,129 | 1,273,243 | 1,366,691 | 1,260,277 | 1,231,354 | 1,140,080 | 1,286,536 | 1,312,199[1] | 1,323,730 | 1,283,927[1] | 1,310,000 |
| Trinidad | 1,086,530 | 1,079,082 | 983,424 | 1,081,191 | 1,026,423 | 1,066,728 | 1,078,186 | 1,121,583 | 1,108,969 | 1,126,420 | 1,179,611 | 1,154,093 |
| British India | 841,764 | 854,644 | 756,384 | 791,162 | 790,376 | 827,762 | 778,947 | 681,136 | 679,512 | 659,347 | 660,000[1] | 658,000 |
| Poland | 308,000 | 338,800 | 323,400 | 338,800 | 323,400 | 331,100 | 287,000 | 294,000 | 301,000 | 294,000 | 301,000 | 294,000 |
| Brunei | 274,540 | 253,400 | 237,930 | 257,250 | 270,900 | 225,890 | 206,780 | 266,700 | 275,310 | 257,040 | 294,070 | 294,560 |
| Germany | 263,879 | 254,492 | 227,444 | 274,393 | 246,519 | 244,552 | 256,613 | 272,699 | 257,859 | 255,556 | 277,158 | 265,650 |
| Japan | 147,827 | 183,651 | 165,877 | 196,569 | 194,167 | 203,071 | 198,387 | 206,284 | 221,139 | 207,260 | 200,528 | 202,385 |
| Sarawak | 140,700 | 139,300 | 127,050 | 136,290 | 130,900 | 134,610 | 128,660 | 130,200 | 129,150 | 122,010 | 127,330 | 122,920 |
| Ecuador | 146,541 | 148,980 | 138,721 | 162,125 | 159,666 | 163,855 | 156,703 | 163,714 | 160,914 | 158,857 | 168,892 | 163,870 |
| Canada[5] | 125,658 | 121,231 | 107,928 | 117,824 | 107,748 | 114,297 | 114,050 | 139,940 | 139,789 | 135,624 | 142,504 | 129,152 |
| Egypt | 94,969 | 91,497 | 97,573 | 111,846 | 101,038 | 107,989 | 106,694 | 106,260 | 102,620 | 98,812 | 102,109 | 97,755 |
| France[1] | 44,981 | 44,981 | 42,079 | 44,981 | 43,530 | 44,981 | 43,530 | 44,981 | 45,000 | 45,000 | 45,000[1] | 45,000 |
| Bahrein[1] | 105,400 | 300,000 | 300,000 | 300,000 | 300,000 | 360,000 | 360,000 | 360,000 | 360,000 | 372,000 | 372,000 | 372,000 |
| Others[1] | 75,000 | 75,000 | 75,000 | 75,000 | 75,000 | 75,000 | 75,000 | 75,000 | 75,000 | 75,000 | 75,000 | 75,000 |
| Total | 145,242,777 | 145,834,270 | 135,972,632 | 148,148,833 | 145,487,944 | 152,514,355 | 146,353,914 | 150,958,565 | 154,162,529 | 148,252,000 | 154,140,351 | 149,571,555 |

[1] Estimate. [2] Anglo-Iranian Oil Co. figures revised; fuel oil returned to the ground has been deducted. [3] International Petroleum Company's figures. [4] International Petroleum Company and Lobitos Oilfields Ltd. figures. [5] Includes natural gasoline production.

Russian Sakhalin included with Russia. Japanese Sakhalin included with Japan.

## Official Crude Oil Production Figures for 1932 to 1936

| | Daily Average to Nov. 30 1936 | Daily Average 1935 | Daily Average 1934 | Daily Average 1933 | Daily Average 1932 | Total to Nov. 30 1936 | Total 1935 | Total 1934 | Total 1933 | Total 1932 |
|---|---|---|---|---|---|---|---|---|---|---|
| United States | 3,322,354 | 2,723,129 | 2,490,704 | 2,462,670 | 2,145,243 | 999,655,350 | 993,942,000 | 909,107,000 | 898,874,000 | 785,159,000 |
| Russia | 559,880 | 469,608 | 462,051 | 407,950 | 409,070 | 175,888,830 | 176,688,100 | 168,648,700 | 149,901,900 | 149,719,000 |
| Venezuela | 486,688 | 421,733 | 385,712 | 331,186 | 326,766 | 151,442,900 | 153,932,611 | 140,784,805 | 120,882,802 | 119,596,512 |
| Roumania | 177,781 | 167,534 | 169,879 | 139,647 | 137,954 | 58,268,000 | 61,150,000 | 62,006,000 | 50,971,200 | 50,491,205 |
| Iran | 160,111 | 143,600 | 144,284 | 135,840 | 123,285 | 52,477,000 | 52,413,879 | 52,663,782 | 48,581,280 | 45,122,455 |
| Netherland India | 122,394 | 116,629 | 115,861 | 105,516 | 108,153 | 40,868,643 | 42,569,625 | 42,289,408 | 38,512,663 | 39,584,027 |
| Mexico | 110,084 | 110,233 | 104,567 | 92,890 | 89,624 | 36,766,996 | 40,234,902 | 38,167,022 | 33,904,882 | 32,802,285 |
| Iraq | 78,638 | 68,085 | 21,742 | 3,288 | 3,300 | 25,053,135 | 24,850,924 | 7,935,657 | 1,200,000 | 1,200,000 |
| Colombia | 54,679 | 48,740 | 47,509 | 36,047 | 44,768 | 17,151,791 | 17,617,654 | 17,340,724 | 13,157,127 | 16,834,956 |
| Peru | 50,515 | 46,270 | 43,663 | 38,146 | 26,026 | 15,861,755 | 16,835,206 | 15,936,937 | 13,923,281 | 9,899,266 |
| Argentina | 47,508 | 39,226 | 39,015 | 38,232 | 35,975 | 14,757,513 | 14,317,500 | 14,045,652 | 13,759,565 | 13,166,900 |
| Trinidad | 39,241 | 31,686 | 29,847 | 26,192 | 27,387 | 12,005,710 | 11,669,792 | 10,894,363 | 9,560,039 | 10,023,780 |
| British India | 24,696 | 25,281 | 24,650 | 23,893 | 23,500 | 8,137,270 | 9,227,496 | 8,997,399 | 8,721,655 | 8,600,312 |
| Poland | 10,282 | 10,885 | 10,130 | 10,570 | 10,670 | 3,433,500 | 3,973,200 | 3,697,617 | 3,858,085 | 3,905,230 |
| Brunei | 8,835 | 8,647 | 7,323 | | | 2,839,830 | 3,162,614 | 2,673,041 | | |
| Germany | 8,811 | 8,409 | 6,211 | 4,692 | 4,983 | 2,832,935 | 3,054,023 | 2,266,964 | 1,712,823 | 1,824,019 |
| Japan | 6,900 | 5,065 | 4,068 | 3,827 | 4,375 | 2,193,318 | 1,848,656 | 1,484,962 | 1,337,761 | 1,575,333 |
| Sarawak | 4,905 | 5,002 | 5,337 | 6,273 | 6,213 | 1,428,420 | 1,811,297 | 1,948,044 | 2,289,472 | 2,274,043 |
| Ecuador | 5,560 | 4,727 | 4,534 | 4,446 | 4,300 | 1,746,297 | 1,725,354 | 1,655,062 | 1,622,624 | 1,573,857 |
| Canada | 4,434 | 3,933 | 3,887 | 3,144 | 2,880 | 1,370,087 | 1,434,467 | 1,418,810 | 1,147,825 | 1,054,373 |
| Egypt | 3,698 | 3,356 | 4,052 | 4,360 | 4,760 | 1,124,193 | 1,215,606 | 1,479,037 | 1,591,495 | 1,742,370 |
| France | 1,497 | 1,451 | 1,512 | 1,515 | 1,508 | 489,063 | 529,664 | 552,000 | 552,000 | 552,000 |
| Bahrein | 11,249 | 3,465 | 781 | | | 3,756,000 | 1,264,809 | 285,071 | | |
| Others | 2,500 | 2,470 | 2,359 | 1,184 | 1,180 | 825,000 | 900,000 | 861,000 | 432,000 | 432,000 |
| | 5,186,395 | 4,470,161 | 4,129,678 | 3,884,022 | 3,544,940 | 1,631,144,948 | 1,636,369,379 | 1,507,139,057 | 1,417,534,479 | 1,296,682,923 |




*World crude oil production by months, 1933–1936. Chart is weighted to compensate for variation in number of days per month. Ratio of U.S. crude production to world production.*

# World Petroleum Abstracts

*Summaries of the Most Important Articles as Published in the Oil Press of the World Dealing With Technical and Economic Aspects of the Industry.* *Edited by Dr. O. W. Willcox*

## Petroleum Geology

AERIAL GEOLOGIZING.—Leon T. Eliel and Wm. H. Meyer, Jr., in TECHNICAL PUBLICATION NO. 756, Petroleum Div. A.I.M.M.E., Nov. 1936.

The authors present an informing summary of the present state of aerial reconnaissance and contour mapping and the development of the necessary aerial photographic equipment, which is now a highly complex and specialized art.

The uses to which aerial photography may be put are almost limitless. Some of them are as follows: tax adjustments, right-of-way negotiations, transmission-line engineering, real estate developments, forest survey, mining geological surveys, industrial engineering, oil prospecting, highway development, harbor surveys, projects for conservation of natural resources, dam and watershed engineering, community improvement planning, and establishment of property lines. One advantage is that the survey can be made without the knowledge of local inhabitants, who are not stirred up or given warning to boost land prices.

Cameras are now available for every photographic purpose, and airplanes have been specially designed for the various conditions encountered in actual service. Maps can be made to a scale as large as one inch equals 20 ft. The cost of such surveys depends greatly on local conditions and detail required, and may range between $1.25 to $200 per square mile.

EVIDENCE OF RECENT MOVEMENTS ALONG FAULTS OF THE BALCONES SYSTEM IN CENTRAL TEXAS.—Frank Bryan, in BULL. AM. ASSOC. PETROL. GEOLOGISTS, vol. 20 (1936), No. 10, pp. 1357–1371.

The so-called Balcones fault system of central and eastern Texas is an interesting regional phenomenon. It is peculiar in that it is more a system of grabens than a fault system proper. There is reason to believe that it is the surface expression of a comparatively recent, deep-seated, uplifting movement. Archeological finds suggest that there has been considerable movement in certain sections within the last 3,000–5,000 years. There is some evidence which suggests that the uplifting movement is still actively alive. It is believed that the faults of this system have not been a constructive cause of the accumulation of oil into the pools they border. Rather, it is believed that the faults have been destructive.

SUMMARY DIGEST OF THE GEOLOGY OF TRINIDAD.—H. G. Kugler, in BULL. AM. ASSOC. PETROL. GEOLOGISTS, vol. 20 (1936), No. 11, pp. 1439–1453.

Trinidad is a part of the Caribbean Coastal Range of Venezuela and displays all the structural characteristics of this mountain system.

The discovery of new oil fields in Trinidad is highly probable, but owing to complicated geological conditions information obtained from intensive wildcat drilling should supplement that from geologic mapping. Indications of oil in the Cretaceous of Trinidad are almost as common as those in beds of the same age north of the Guanoco area of eastern Venezuela. With the exception of insignificant production in the Lizard Springs field, no oil has been found in the Cretaceous of Trinidad. No beds older than the Cretaceous have been found in Trinidad.

MEANS OF RECOGNIZING SOURCE BEDS.—Parker D. Trask and H. Whitman Patnode, before Amer. Petrol. Inst., Chicago, 1936.

Eight characteristics of sediments are considered as possible means of recognizing source beds: (1) quantity of organic matter in the sediments; (2) reducing power, which is a measure of ability of the sediments to reduce chromic acid; (3) color of sediments; (4) volatility of sediments; (5) degree of volatility, which is a measure of the volatility with respect to the organic content; (6) ratio of carbon to nitrogen in the sediments; (7) oxidation factor, which is an index of the state of oxidation of the sediments, and is the ratio of the carbon content to the reducing power; and (8) the nitrogen-reduction ratio, which is the ratio of the nitrogen content to the reducing power. Several thousand determinations of these characteristics have been made and averaged from more than 800 lithologic units from many areas in the California, Rocky Mountain, Mid-Continent, East Texas, and Gulf Coast oil regions. The thickness of these units ranges from 50 ft. to 500 ft.

These criteria appear to vary in value. The organic content and color are at best rough indices. The oxidation factor is apparently not a particularly useful index of source beds except in the Mid-Continent area; this factor requires further investigation. The reducing power shows a slight relationship but is subject to many exceptions. The usefulness of the carbon-nitrogen ratio is equivocal and requires further elucidation. The volatility of the sediments within the individual petroliferous provinces seems to be a fairly good index of source beds, but it differs much from province to province.

The nitrogen-reduction ratio appears to have very good possibilities as a means of recognizing source beds. Relatively few beds in which the ratio is less than 4.5 seem to be poor source beds, and comparatively few beds in which the ratio is greater than 7.0 seem to be favorable source beds. The average for beds associated with oil zones is definitely greater than the average for those associated with "barren" zones in each of the five regions studied. The nitrogen-reduction ratio is comparatively simple to determine, and the reliability of individual determinations is high. This ratio, therefore, can be recommended for very serious consideration as a means of recognizing source beds.

## Geophysics

THE ORGANIZATION OF AN EFFECTIVE EXPLORATION DEPARTMENT.—B. B. Weatherby, in GEOPHYSICS, vol. 1 (1936), No. 2, pp. 179–188.

The author reviews the functions of a Land, Lease and Exploration Department in a large oil company, and describes in detail the integral parts. Criteria are furnished for the background of men suitable for the various positions, and a detailed organization chart is submitted which also shows the flow of information secured from the various field methods. Much stress is placed upon the need for detailed, routine reports. The part played by contracting geophysical exploration companies is also described, and the extent of the service which they should render is shown.

NEW GEOPHYSICAL METHOD.—W. A. Sawdon, in PETR. ENG., vol. 8 (1936), No. 1, pp. 25–29.

A defect of the present seismic methods of geophysical exploration is that they will often supply data that are too confusing for close interpretation. A new method, named the Rieber Geo-Sonograph method, has been developed to mitigate these defects.

As in ordinary seismographic operations the new method uses the discharge of a shot at one point, the reflected waves being picked up by geophones at other points at known distances from the shot. When the reflected waves reach the geophones in a direction normal to the surface a clear record is the result. When the waves reach the surface at an angle the record is less definable.

The new method overcomes this defect by a new method of recording. Ten receptors are arranged in an appropriate pattern on the earth's surface, and the wave impulses picked up by all 10 receptors are photographed on a film in the form of 10 sound tracks which may be inspected visually; or the film is run through a specially designed apparatus that sums up the wave impulses and records them in a clearly defined line. By means of this analyzer the difference in time of arrival at successive receptors and the total travel time to any point in the receptor group may be found mechanically from the variable density record;

human observational errors are thus eliminated.

A directionally sensitive receiving means is incorporated in the analyzer which records impulses for one direction in space; then the apparatus automatically sets itself to trace impulses from another angle. For a satisfactory average working result 40 trips through the analyzer may be necessary.

The field crew used in this method is about equivalent in number to that used in other reflection work; the drilling requirements are also about the same, except that shallower holes may be used. There also appears to be some advantage in speed of operation.

**Progress in Magnetometer Exploration.**—James A. Dick, in CALIF. OIL WORLD, vol. 29 (1936), No. 15, pp. 7–8.

Compared with what it was 10 years ago the magnetometer method of geophysical surveying is now greatly improved. Formerly the minimum error was about 10 gammas (1 gamma = one one-hundred-thousandth of a gauss); this error has now been reduced to two gammas by improved construction that reduces the temperature coefficient to little or nothing. Other sources of error have been eliminated by an improved leveling technique. The result has been to make the magnetometer something more than a reconnaissance instrument. Fault problems that were previously incapable of solution are now being mapped out successfully. In view of these improvements it may be worth while for oil operators to turn their attention once more to this oldest, simplest and least expensive of geophysical methods. A renewed interest in the method is noted in the Mid-Continent and Rocky Mountain regions.

## Drilling

**Three Twin Cylinder Engines on a Rotary Rig.**—I. P. Sanders, in OIL & GAS JOUR., vol. 35 (1936), No. 15, pp. 58–60.

A new departure in rotary drilling equipment is noted in the Rodessa field where three vertical, twin cylinder steam engines are used, thus differing from all other rigs used in the Mid-Continent area. Each engine serves for only one purpose. The largest one drives the draw-works through a dual chain drive and has 12-in. cylinders and a 12-in. stroke. The rotary table is driven by direct shaft from a smaller vertical twin cylinder engine which has cylinders 7¾ x 7 in., and is installed on the derrick floor. The mud pump is belt-driven by a similar engine.

This arrangement avoids the necessity of continuously running the large hoist engine when the latter is also used to run the mud pumps during drilling; hence the large engine may be shut down except during hoisting operations. A horizontal duplex steam slush pump is installed as stand-by equipment. The Brantly feed control is used on this rig. According to the operators a considerable economy is effected in gas and water consumption, the saving in fuel and water being approximately 50 percent.

**Drilling-in Under Controlled Pressure.**—K. C. Sclater, in PETR. ENG., vol. 7 (1936), No. 12, pp. 25–28.

Initial pressures in the Mansion House area of the Oklahoma City pool dropped from 2,600 lbs. per sq. ft. to 575 lbs. At this low pressure it was evident that mud fluid, and even heavy oil, were unsuitable for circulation during the final period of drilling-in because, owing to their density and resulting hydrostatic pressure, they penetrated the productive sand and interfered with the natural capacity of the well to produce. To avoid this difficulty use has been made of a light circulating fluid composed of a mixture of gas and oil, and the drilling-in is finished under controlled pressure.

When the top of the producing sand has been reached the heavy drilling mud is ejected by gas lift in stages of 300 ft., more or less. When the hole has been cleared of mud the drill stem is packed off in the casing at the Kelly, and drilling-in under gas-oil pressure is begun. Gas at a minimum rate of 2,000,000 cu. ft. a day, and from 18 to 25 bbl. of oil are the average quantities required for circulation to keep the hole clean and the bit lubricated. As the sand is penetrated and the well begins to produce gas and oil the composition of the circulating fluid is adjusted accordingly. The extraneous gas is usually injected at a pressure of 400 to 600 lbs. Accurate measurements of quantities and pressures are necessary in order that the producing capacity of the well may be computed for each foot of penetration. Washing-in is unnecessary, as the sand is not muddied off. The method appears to be eminently suitable for drilling-in where wells are deep and the reservoir pressure is low.

**Correcting Crooked Holes by Using Fibered Cement.**—I. P. Sanders, in OIL & GAS JOUR., vol. 35 (1936), No. 16, p. 42.

Several wells in the Oklahoma City field that were found 5¼ to 6 deg. off vertical were plugged back with neat cement. When drilling was resumed with the idea of straightening the hole it was found that the drill persisted in following the old holes, evidently because in 10 days the cement had not hardened sufficiently to deflect the bit. Use of a whipstack was no more successful. Then the holes were plugged back with fibered cement, which was given five days to harden, whereupon drilling was resumed. It was found that the drill passed out of the cement in a straight line. This effect is ascribed by the drillers to the fact that the fibered cement "drills harder" than neat cement, due to the cushioning effect of the fibers, and the method has attracted the attention of other drillers in the field.

It is said that several hundred thousand sacks of fibered cement have been used for cementing casing and to date no failures have been recorded.

## Oil Well Operation

**Progress in Bottom-Hole Choking.**—H. C. Otis, in PETR. ENG., vol. 7 (1936), No. 13, pp. 31–32.

During the past year approximately 150 high-pressure wells have been equipped with bottom-hole chokes to forestall freezing at the surface and to simplify the regulating problem. Such chokes have been installed where the surface pressures are as high as 3,200 lbs. and in wells with depths beyond 7,000 ft. New attempts are being made to lower gas-oil ratios by means of bottom-hole chokes; not all these attempts have been successful, an exception being the Peasel field in Kansas; here the wells are about 3,400 ft. deep and are equipped with 2-inch tubing. Prior to installation of bottom-hole chokes the gas-oil ratios were approximately 10,000 cu. ft. per bbl.; after installation of the bottom-hole chokes this ratio was reduced to practically a third. However, lowering of gas-oil ratios by this means can be had only when tubing flow velocities without the use of bottom-hole chokes are so low as to cause slippage—whether these low velocities result from high pressures and low rate of withdrawal or whether they result from an inadequate supply of gas—or when considerable heading is taking place.

A new form of bottom-hole choke that has been lately introduced is described as a "side door choke." The purpose of this choke, which can be run and pulled under pressure on a Halliburton line, is to permit the introduction, under control, into the tubing of gas from the annular space between the tubing and casing, while normally allowing unrestricted passage of oil from bottom. In effect, it might be compared to a removable jet collar, or to a jet collar that can be run into or pulled from a well on a Halliburton line to permit changing the jet diameter.

An example of a possible application of this "side door" choke lies in a well that has been gun-perforated into an upper gas sand to obtain additional gas to aid in flowing the well's oil production. Such perforating, whether or not done with the well loaded, may bring in far more gas than is necessary to maintain flow at the desired rate, with high gas-oil ratios as a result. The new choke would serve as a readily variable means of admitting only the desired amount of this gas into the tubing, at the same time ordinarily affording no material restriction to the flow of the oil. Another possible application would lie in those wells that employ a formation packer to separate oil and gas horizons, yet in which it is necessary to use some of the gas shut off by the packer. Still another possible application would lie in a well of low bottom-hole pressure that has a large volume of free gas between the tubing and casing, and in which it is desired to utilize this gas for flowing the oil, without, however, disturbing the liquid seal in the well.

**Subsurface Photography in a Fishing Job.**—Neil Williams, in OIL & GAS JOUR., vol. 35 (1936), No. 13, pp. 29–30.

In addition to previous uses of subsurface photography for facilitating directional drilling, it has now been employed to make a record of conditions in a hole with the object of determining the nature of obstructions and to facilitate fishing jobs. The invention of an apparatus for the purpose was first made necessary in a case where a well had been deliberately obstructed in an effort to prevent a directional survey in pursuance of a court order. Hence the nature of the "fish" was not known.

The photographing instrument consists of an open-bottomed cylinder containing a timing device, batteries, a camera and photo-flash bulbs, by which informative pictures could be taken. In this case the fish was located above

the liquid level. Later the instrument was modified so that it could be used in holes filled with muddy water. Experiments are also being carried out in the use of infra-red films which may make possible the taking of pictures filled with mud.

**Intermittent Application of Gas In Repressuring.**—T. P. Sanders, in OIL & GAS JOUR., vol. 35 (1936), No. 24, p. 42.

From experience in Western Pennsylvania it has transpired that intermittent introduction of the repressuring gas gives better results than a constant steady pressure, at least during the later stages of a repressuring program. The explanation seems to be that when the pressure is kept high the gas tends to channel, and so to run ahead of the oil; by allowing the pressure to fall, the slower moving oil has more chance to seep into the channels, and thus more oil is driven along. As an example, a lease at Titusville had declined to 1½ bbl. a day and the gas was channeling badly; by switching to intermittent input of gas, production was increased to 4 bbl. a day. The correctness of this explanation has been substantiated by laboratory experiments at Penn. State College, where intermittent pressure was found to recover more "dead oil" from cores in 16 hours than by steady application of pressure during 48 hours, and only one-third as much compressed air was required. Arrangements are being made to extend this practice in the district.

**Field Stabilization of Crude Oil.**—L. E. Smith, in NAT'L. PETROL. NEWS, vol. 28 (1936), No. 39, pp. 30–37.

The absorption gasoline plant and crude oil stabilization plant of the Continental Oil Co. in the Tepetate field, Louisiana, is unique in the fact that it is the only plant in the U. S. where the oil production of the field is metered at a common center. At the wells there are only the standard hook-ups connecting to a system of gathering lines which move both gas and oil to the central battery of separators. Here gas and oil are separated and both gas and oil are metered, the separators being numerous enough to handle the production of each different royalty interest in the field. After metering, the crude oil and gas go to the gasoline plant separators.

## Natural Gas

**Natural Gas Reserves in Michigan "Stray" Sandstone.**—E. L. Rawlins and M. A. Schellhardt, in BUR. MINES REPORT OF INVESTIGATIONS NO. 3313, July, 1936.

This 139-page monograph, with 16 illustrations, gives a detailed survey of present and possible future reserves of natural gas in central Michigan. The total proved and semi-proved initial recoverable gas reserve of this area is put at about 47,700,000,000 cu. ft., of which some 6,300,000,000 cu. ft. have now been withdrawn. Future developments in proved fields may add another 12,000,000,000 cu. ft. and possible new gas fields yet to be proved may yield approximately 21,000,000,000 cu. ft. The data given on the individual gas wells in this district are very comprehensive.

**Conversion of Natural Gas to Carbon Monoxide and Hydrogen.**—W. A. Karzhavin, in IND. ENG. CHEM., vol. 28 (1936), No. 9, pp. 1042–1044.

Of the possible uses of the methane in natural gas as a raw material in chemical industry, its utilization as a source of hydrogen for ammonia synthesis or for hydrogenation is especially attractive. Hydrogen may be produced from natural gas by thermal cracking of the methane to yield carbon and hydrogen, or by steam conversion of the methane to yield carbon monoxide and hydrogen, with subsequent steam conversion of the carbon monoxide at 500 deg. C.

The thermal cracking process is used in industry to obtain hydrogen for ammonia synthesis and to obtain lampblack only. Since the hydrogen made contains 5 to 20 percent undecomposed methane, it must be purified before use by cooling and washing with liquid nitrogen. Because of the expense of such purification and the comparatively low yield of hydrogen (half that obtained from steam conversion), this process is to be preferred over the steam conversion process only when it is desirable to produce hydrogen and lampblack simultaneously.

In the present work the process of converting natural gas with steam to produce carbon monoxide and hydrogen is tested on a semi-industrial scale. It consists in heating a gas-steam mixture in an apparatus, provided with chamotte regenerative packing, and passing it over a nickel catalyst. The methane content of the converted gas is, on the average, 0.8 percent.

During conversion 1.9 cubic meters of steam (1.5 kg.) are added to one cubic meter of the natural gas, and 3.3 cubic meters of converted gas are produced containing 64 percent hydrogen and 22 percent carbon monoxide. The total consumption of natural gas per cubic meter of a pure nitrogen-hydrogen mixture is 0.44 cubic meter, taking into account the gas consumption both for the conversion and for the heating of the packing. One cubic meter of the reaction chamber volume can yield 24 cubic meters of converted gas per hour.

## Pipelines

**Phosphate Rust-Preventing Process.**—W. Overath, in CHEM. ZTG., vol. 60 (1936), No. 63, pp. 741–742.

The idea of producing a rust-preventing coating on iron and steel by a treatment with dilute phosphoric acid or a solution of a metal phosphate dates back to 1900. The first results were not very satisfactory, but the matter was kept under continuing study, until in 1931 it was put on a commercial basis in certain lines of production.

In this phosphatizing process the well-cleaned metal is dipped into a weak solution of phosphoric acid, or preferably a solution of acid manganese phosphate $Mn(H_2PO_4)_2$. By adding a copper catalyzer the reaction is completed in a few minutes, the result being a thin coating of insoluble iron phosphate that excludes the underlying metal from the air. In itself the phosphate coating is not very resistant to mechanical abrasion, and needs to be covered with a coating of tar, paint or similar material. The special advantage of the phosphatizing treatment is that in case of abrasion of the phosphate coating, rusting is confined to the exposed portion, there being no formation of local electro-couples. All ordinary irons and steels, except high alloy steels, may be phosphatized.

**Use of Non-Ferrous Metals Underground.**—K. H. Logan, in OIL & GAS JOUR., vol. 35 (1936), No. 19, p. 137.

In studies of the effects of soils on non-ferrous metals and alloys, the Bureau of Standards has buried approximately 9,000 specimens of pipes and 1,000 specimens of metallic protective coatings. A number of these specimens have been exhumed and examined.

From this examination it is concluded that no non-ferrous metal has been found that will be suitable for all conditions, but for each condition one or more metals or alloys are available which resist corrosion very well. Copper and brasses that are high in copper are suitable for soils free from sulphides, and lead is very resistant to soils containing sulphur compounds.

Metallic coatings extend the life of buried materials, but under some soil conditions offer only temporary protection. Of the metallic coatings tested, zinc coating appeared the best in most soils.

For best results the characteristics of the soils must be known, and the materials must be selected in the light of this knowledge.

## Petroleum Refining

**Re-running Acid-Treated Cracked Naphthas over Alkalies.**—George M. Woods, in PETR. ENG., vol. 7 (1936), No. 12, p. 38.

In acid-treating cracked naphthas a certain amount of dialkyl sulphates are formed; however, if the cracked naphtha is treated with enough strong sulphuric acid the dialkyl sulphates are almost completely removed from the naphtha layer; the rest break down when the treated naphthas are re-run, sulphur dioxide being liberated which darkens and deteriorates the naphtha overhead.

The author finds that if in re-running acid-treated cracked naphtha sufficient caustic or soda is added to the still along with the oil charge to neutralize completely all the sulphur dioxide formed from the breaking down of the alkyl sulphates, the product is not only improved but much less acid can be used. In a refinery where 7,000 bbl. of cracked naphtha was processed in a unit designed by the operating personnel, the cracked product was treated with 12 lb. of 98 percent sulphuric acid per barrel, followed by a water and caustic wash and 10-day storage before re-running. After some experimentation it was found that by reducing the quantity of acid to six lbs. per barrel and re-running over eight cc. of caustic solution per gallon, a better product could be obtained and a saving of some $330 a day in acid expense could be effected. No caustic embrittlement of the still bottoms has been observed as a result of introducing the caustic into the hot stills.

COAL AND OIL: A COMPARISON OF SOME OF THEIR HYDROGENATION PRODUCTS.—M. Pier, before Am. Chem. Soc., Gas & Fuel Div., Pittsburgh, 1936.

By use of destructive catalytic hydrogenation, fuels like coal, tar, petroleum and shale oil give high yields of products usually obtained from mineral oils. Practically the only by-product is a certain amount of gaseous hydrocarbons which, however, may be utilized in the process by conversion to hydrogen. Catalytic hydrogenation makes possible the production from the same raw material of different final products such as fuel oil, lubricating oil, Diesel oil, illuminating oil, or gasoline, according to the market demand.

In the sump phase hydrogenation described in this paper, heavy raw materials are treated in the liquid state. Such materials as asphaltic petroleum or cracking residues, tars, and coals (the latter finely ground and pasted with oil) are mixed with a finely divided catalyst and subjected to hydrogenation at elevated pressure and at temperatures of about 400 to 500 deg. C. In this manner heavy oil, middle oil and some gasoline are produced. The middle oil can be further split in the gas phase to gasoline over lump-shape catalyst, rigidly arranged in the reaction vessel. The same catalyst arrangement may also be used just as well for the improvement of lubricating oils and illuminating oils, for the refining of gasoline, benzol, etc. and for the production of antiknock gasoline. The life of rigidly arranged catalyst is much longer than one year. It is characteristic of catalytic destructive distillation that the conversion of the raw materials can be carried out so mildly that their valuable properties are retained in their hydrogenation products. In this case, the composition of the raw material reappears in the ultimate analysis of the hydrogenation products of the sump phase, i.e., asphalts, heavy oils, middle oils, sump phase gasolines. The analytical figures become increasingly similar as the boiling point of the products compared decreases, but even with the gases differences are still noticeable. There is a marked similarity of sump phase products from oil residues and straight run products from the same crude oils. Products of the sump phase hydrogenation when using but small amounts of finely distributed catalyst, still contain some part of the oxygen, nitrogen and sulfur compounds present in the raw material. The products treated over rigidly arranged catalyst, however, are usually completely refined.

The equipment used for the hydrogenation is in all cases practically the same. A plant, which has been used for oil can be converted easily for tar or coal. However, in the latter case, additional equipment has to be provided. Also with the same equipment a great variety of final products may be obtained.

HYDROGENATION.—F. S. Sinnatt, J. G. King and Angus MacFarlane, before Am. Chem. Soc., Gas & Fuel Div., Pittsburgh, 1936.

In 1923 experimental work on hydrogenation was started at the Fuel Research station, Great Britain, to ascertain whether British bituminous coals could be readily converted to motor spirit. After a study of catalysts, an experimental plant of one ton per day capacity was constructed. The mechanism of coal hydrogenation has been studied especially for the light it sheds on coal constitution. Special attention has been given to the hydrogenation and treatment of low temperature tars, the properties of which are described. The influences of pressure and temperature upon the hydrogenation and cracking of the aromatic constituents of low temperature tars are reviewed, especially with reference to naphthalene. The influence of temperature from 300 deg. to 510 deg. C. and of pressure at 200 and 400 atmospheres on the hydrogenation of tar in a continuous plant were studied. After hydrogenation above 370 deg. C. the tar loses its black color but remains opaque, at 450 deg. C. the product is transparent and pale yellow in color. Deterioration of catalyst increases with increasing temperature of operation. The construction and operation of the semi-technical scale size tar hydrogenation plant now in use is described together with analyses of the raw and treated tars. Temperature conditions in the catalyst chamber and means for dissipating the heat of reaction are described.

SOLVENT EXTRACTION PROCESSES.—R. E. Hersh, in NATL PETROL. NEWS, vol. 28 (1936), No. 45, pp. 30–40.

Although solvent extraction was introduced in petroleum refining by Edeleanu over 25 years ago for the purification of distillates by means of liquid sulfur dioxide, subsequent development of this application did not assume ambitious proportions until within the last five to six years. At the present time the refiner has a choice of a variety of solvents or combination of solvents and of different types of processes. To refiners interested in solvent extraction of their oils the question now becomes one of which solvent or process could be best adapted to their particular purposes or requirements. Considerable information has been published on the merits of each type of solvent and solvent extraction process but the data presented on each cannot be compared directly because of different operating conditions and charging stocks. In the course of a research program conducted at the Petroleum Refining Laboratory, Pennsylvania State College, a number of solvents were tested on several stocks to determine the relative characteristics of the products obtained by their use.

This article shows in a comprehensive manner the comparative results obtained by treating fractions with different solvents for effect on carbon residue, color, viscosity index and other properties. An interesting application made in the Pennsylvania laboratory is the use of extract, wholly or partially freed from solvent, as reflux in counter-current extraction systems. This method appears to improve the efficiency of separation of low V.I. extract from high V.I. raffinate, and to offer excellent possibilities for improvement in solvent extraction processes.

Note.—This paper is, in effect, a further contribution to the recently revived concept of multiple extraction as an analogue of the process of fractional distillation. With a fractionating column a composite volatile liquid can be separated into an indefinitely large number of different fractions. Similarly, by using a tall tower and the principle of countercurrent flow with reflux, a given solvent can make as sharp a separation as may be desired of the different components of a lube oil, instead of six extraction stages, which seems to be about the limit with the batch operations now in use. A tower extractor can make 12 or more, thus increasing the possible range of special grades. —Ed.

HOT OIL PUMPS.—M. G. Van Voorhis, in NAT'L PETROL. NEWS, vol. 28 (1936), No. 45, pp. 43–46.

Economies made possible in large cracking units by the development of centrifugal pumps for high temperature and pressure operation have been extended to smaller units and to other operations in refineries to such an extent in the past few years that they apparently threaten to monopolize the field of refinery pumping. Impractical a few years ago for high temperature and pressure operation, the centrifugal pump was recognized as having attractive possibilities and as being almost a necessity in the desirable larger sized cracking units.

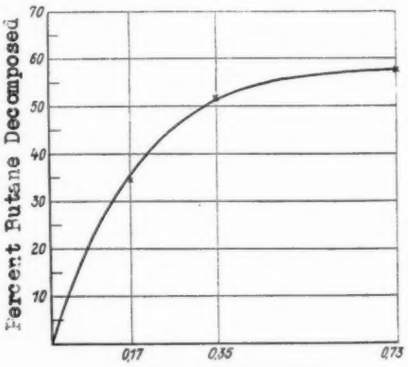
The field of operations for which this discussion is most concerned is that for temperatures above 400 deg. F. and above 50 atmospheres pressure. Hot oil charging pumps are being built to withstand up to 1000 deg. F. and to build pressures up to 2500 pounds per square inch which is nearly 170 times atmospheric pressure.

There are several reasons why refiners wanted the pumping characteristics of the centrifugal. One was that its space requirements were a half to a third that of the reciprocating pump in the same service and its first cost could be brought to a proportionately lower figure. Another reason is its pulsationless flow. Its value in this respect has been to lengthen the life of equipment, including meters, by the reduction of stresses.

However, this is not to be taken to mean that there have not been improvements in reciprocating pumps; they are, in fact, maintaining a hold from which they are unlikely to be displaced, particularly as regards the handling of lighter products, as in the new polymerization processes.

STUDY OF REFINING CRACKED DISTILLATES WITH HIGH SULPHUR CONTENT.—F. Sager, in JOUR. INST. PETROL. TECH., vol. 22 (1936), No. 155, pp. 609–615.

Treatment of cracked distillates with a given amount of sulphuric acid of a given concentration results in a definite sulphur content of the finished gasoline, if the reaction is carried to equilibrium conditions.




The equilibrium conditions for desulphurization of cracked distillates with a given amount of acid are reached in less than 60 seconds.

With the important proportions of acid necessary for reasonable desulphurization, contact periods, longer than strictly necessary for

reaching equilibrium conditions, result in heavy losses of hydrocarbons. Those further losses of the less stable hydrocarbons mean increased gum stability.

Stopping the reaction when equilibrium conditions for desulphurization are reached means saving of valuable hydrocarbons. Additional stability can be obtained by adding a suitable gum inhibitor to the finished product (in the cases discussed in this paper, a natural inhibitor).

In respect to desulphurization, gum stability and polymerization losses, the true counter current, two-stage refining has a similar effect to single-stage refining, with a somewhat increased amount of acid.

The equilibrium point is ascertained by an experimental run to plot sulphur content in finished gasoline against reacting time in seconds. Results obtained on an Iranian cracked distillate are shown in the accompanying diagram.

**An Apparatus and Method for Continuous Hydrogenation Tests on Coal.**—T. E. Warren and R. E. Gilmore, before Am. Chem. Soc., Gas & Fuel Div., Pittsburgh, 1936.

This paper describes in detail an apparatus and method for continuous hydrogenation tests on coal and other materials, developed at the Fuel Research Laboratories of the Canadian Department of Mines. The hydrogen is continuously analyzed, compressed and passed to the bottom of the reaction chamber. This is an electrically heated vertical tube 10 ft. in length with an internal diameter of 2.74 inches. A suspension of powdered coal in oil, produced in a previous cycle, together with stannous oxide as the catalyst is charged also to the bottom of the reaction chamber. The product is withdrawn from the top of the chamber, cooled to room temperature, and collected in a receiver where it separates into liquid and gaseous fractions. The gaseous fraction, which is largely hydrogen, is measured and recirculated through the reaction chamber without reducing the pressure. The liquid product is withdrawn at regular intervals from the receiver. The apparatus and procedure were used in experiments on a typical high-volatile bituminous coal for the purpose of determining the effects of changes in three operating variables, viz., pressure, rate of charging and temperature. The best yields as percent of the charge of ash-and-moisture-free coal were as follows: hydrogen used 8.0; net oil produced, 77.6; solid residue 6.3; water, 7.7; gas and loss 15.7. These yields were obtained with a temperature of 829 deg. F., a pressure of 2,940 pounds per square inch, and a charging rate of 8.83 pounds of paste per hour. At a pressure of 2,430 pounds per square inch, with other conditions as previously stated, the yield of oil was 72.5 percent. At a rate of charging of 6.04 pounds per hour, the yield of oil was 53.7 percent, and at a temperature of 857 deg. F. the yield of oil was 54.9 percent.

**Thermal Decomposition of Propane.**—W. Schmieden, in REV. PETROL. No. 710 (1936), p. 1716.

With the object of obtaining olefines, propane was subjected to pyrolysis at temperatures from 650 deg. to 860 deg. C. in a "Sichromal" steel tube. The best yields of unsaturated products were obtained at 730 deg. to 790 deg. C., amounting to about 75 percent. The formation of acetylene is small, but increases with the temperature. At 760 deg. C. there are formed about 72 percent of olefines; carbon deposition amounts to about one percent, depending on the duration of the reaction, and is the greater the lower the temperature (650 deg. C. for instance).

**Destructive Hydrogenation of Roumanian Petroleum Residues.**—C. Candea and A. Marschall, in CHIM. IND. (Paris), vol. 36 (1936), No. 3, pp. 463–468.

A fraction of a Moreni crude boiling above 340 deg. C. was subjected to destructive hydrogenation in the presence of a catalyzer consisting of 13.4 grams of $MoS_3$, 4 g. of MgO and 2.6 g. of $Al_2O_3$. This catalyzer was mixed with the residue in the proportion of 1 to 10 by weight. The operation was conducted in an autoclave.

In operations under a pressure of 100 to 300 atmospheres at a temperature of 350 deg. C. the liquid portion amounts to 70 to 80 percent; the yield of gasoline boiling up to 150 deg. C. was a maximum of 44 percent. Up to a pressure of 230 atmospheres the proportion of unsaturated hydrocarbons in the gasoline decreased, whereas the proportion of naphthenes increased. As the pressure was raised the formation of coke decreased from 15 to zero percent. The quality of the gasoline obtained is said to be superior to that obtained by cracking; on the whole it is more saturated, more stable and has a better anti-knock quality; less gum is formed and sulphur is nearly entirely removed.

**In Praise of Catalysis.**—V. N. Ipatieff, in CALIF. OIL WORLD, vol. 39 (1936), No. 1473, pp. 14–15; 26–27.

Some catalytic reactions, viz., straight polymerization and also selective and mixed polymerization, are applied on a large scale; and hundreds of thousands of barrels of excellent gasoline with high octane number are being produced in the United States by these reactions. Although the method of polymerizations of olefins under pressure without the use of a catalyst is also employed in some plants, a careful consideration of the comparative merits of these two methods brings us to the conclusion that the catalytic method has numerous advantages. With the use of a catalyst we are able to produce, by means of selective polymerization and catalytic treatment of olefins, a very good yield of special gasoline for aviation. This gasoline has an octane number of about 100, without addition of any tetraethyl lead Polymerization at high pressures and temperatures without a catalyst, cannot produce such a good yield of aviation gasoline. Catalytic methods with a carefully-selected catalyst are sometimes actually capable of producing theoretical yields—which has never been possible by pyrolysis. Catalytic methods permit us to select from the mixture of substances only those which we need, without ruining the others which can be subsequently utilized for polymerization. When pyrolysis of paraffins, rather than catalytic dehydrogenation is employed the yield of olefins is considerably lower, and the hydrogen is contaminated by such gases as methane, ethane, etc., which diminishes its value for hydrogenation.

Another important catalytic reaction is the direct alkylation of paraffins and naphthenes by the olefins. This reaction makes it possible to introduce the radicals into the molecules of certain hydrocarbons. For example, the alkylation of iso-butane produces directly a good yield of iso-octane having a high octane number. By this method we can produce various saturated hydrocarbons of iso-structure, such as iso-heptane, iso-decane, etc. The advantages of this method are obvious. Further investigations of this reaction undoubtedly will make it possible to commercialize this method.

Undoubtedly, the "reforming" process considerably improves the quality of gasoline; but as with any pyrolysis, it is accompanied by the formation of gases such as methane, ethane, etc., and of other normal paraffins. The more delicate method of catalytic destructive alkylation will allow us to treat saturated hydrocarbons in such a way that the gasoline produced will have a high octane number, and the gases will contain a very important hydrocarbon, iso-butane, which is so desirable for alkylation.

Cracking, which at the present time is applied on such a large scale, will probably be modified by the introduction of catalysis. Since the various hydrocarbons contained in petroleum will require different conditions of time, temperatures, pressure, etc., for catalytic decomposition and iso-merization, it is probable that "selective catalytic cracking" will be necessary—starting with specific distillates for each operation.

## Petroleum Chemistry

**Pyrolysis of Propane and the Butanes.**—Gustav Egloff, Charles L. Thomas and Carl B. Linn, in IND. ENG. CHEM., vol. 28 (1936), No. 11, pp. 1283–1294.

One way to a better utilization of the paraffin hydrocarbons in natural or refinery gases is to transform them into the chemically more active olefins, which is now being done by means of pyrolytic methods. Much data relating to these pyrolytic methods have been accumulated but up to the present there has been a lack of data that would correlate maximum olefin concentrations obtainable with the yields, amount of original hydrocarbon reacted, and the effect of temperature, reaction time and pressure under strictly comparable conditions. It is the object of this investigation to furnish such correlations for propane between 600 and 700 deg. C. at 1 kg. and 7 kg. per square centimeter, for *n*-butane at 600 to 650 deg. C., and for isobutane at 650 deg. C.

In all the experiments studied, the effect of increasing the reaction time was to increase the amount of hydrocarbon reacting and to increase the concentration of olefins to a maximum, after which an increase in time produced a decrease in olefin concentration. When two or more olefins were produced simultaneously, their maxima usually occurred at different times; the propylene maxima took place at shorter contact times than those of ethylene.

Increasing the temperature increased the maximum concentrations of olefins obtainable from a given gas. A temperature increment of 50 deg. increased the reaction rate roughly 7 to 8 fold at 1 kg., but at 7 kg. per sq. cm. the increase was only 4 fold.

Increasing the pressure from 1 to 7 kg. per sq. cm. increased the reaction rate at 600 deg.

C., but this effect disappeared at 650 deg. with *n*-butane and at 700 deg. with propane. The same pressure change increased the production rates of the olefins by 6 to 8 fold with the exception of isobutane which was actually decreased 1.7 fold by the application of 7 kg. per sq. cm. pressure.

By taking into consideration certain second-order reactions resulting from pyrolysis and assuming that they have a lower energy of activation than the first-order reactions, it is possible to explain these apparently anomalous effects of temperature and pressure. Thermodynamic evidence is presented to indicate that these second-order reactions are at least as probable thermodynamically as others that are known to take place.

The stabilities of the hydrocarbons studied decrease in the following order—propane > isobutane > *n*-butane—when tested under comparable conditions. The apparent stability of these hydrocarbons is decreased considerably by the application of pressure under certain temperature conditions.

**Determination of Elementary Sulphur in Gasoline and Naphtha.**—Charles Wirth 3rd and James R. Strong, in IND. ENG. CHEM., anal. edit., vol. 8 (1936), No. 5, pp. 344–346.

The present criterion of a corrosive gasoline (due to presence of sulphur) is the A.S.T.M. copper strip test, which usually requires three hours and the result is only qualitative.

There have been many methods recommended for the quantitative determination of elementary sulphur in gasoline. Most of these are long or too involved to be satisfactorily used in a refinery doctor treating plant. Time is the essence of most refinery operations and a rapid determination is extremely advantageous. Mercury is often used as a quick method for the detection or estimation of elementary sulphur. It is sensitive to extremely small quantities which are much lower than the amounts required for a corrosive copper strip. A quantitative determination of the precipitated mercury sulphide involves a long and tedious analytical procedure. In addition, mercury reacts with organic peroxides in cracked gasolines with the formation of a black precipitate similar in appearance to mercury sulphide.

The method proposed in this paper allows a rapid quantitative determination of elementary sulphur which involves a simple laboratory technic readily usable by the small refiner. It is particularly applicable to a ready control of the doctor sweetening process and it may in time serve as a substitute for the copper-strip test in gasoline specifications.

In the determination a known quantity of a mercaptan is added to the gasoline. The mixture is agitated with doctor solution until complete reaction of the sulphur and the added mercaptan has occurred. Since the excess mercaptan is now present as lead mercaptide, it is restored to the original mercaptan by dilute sulphuric acid. Following a wash with acidified cadmium chloride solution to remove the liberated hydrogen sulphide, the gasoline is titrated with silver nitrate solution to determine the excess mercaptan. The used mercaptan, obtained by difference, permits a calculation of the free sulphur content of the original gasoline. The method is not applicable to oils heavier than kerosene because of the difficulties involved in the determination of their mercaptan sulphur contents.

The test can readily be completed in ½ to ¾ of an hour.

**Preparation of Lubricating Oils by Decomposition of Chlorinated Hydrocarbons.**—Anon., in PETROLEUM, vol. 32 (1936), No. 36, pp. 6–7.

A review is given of the application of the Friedel-Craft synthesis to the preparation of lubricating oils. One such product is "Paraflow," which is the commercial name of a lubricant produced in the United States by condensing chlorinated paraffin with benzol or naphthalene in the presence of aluminum chloride and a light hydrocarbon diluent. A similar process has been studied at the University of Birmingham, using metallic aluminum instead of aluminum chloride. Organic compounds are formed containing both chlorine and aluminum, which on decomposition with water and destructive distillation yield viscous oils. On this basis it is proposed to synthesize lubricants from long-chain hydrocarbons, notably paraffin. Solid paraffin, melting at 51 deg. C., is treated with 10 to 25 percent of chlorine in the presence of iodine as catalyzer. The chlorinated paraffins thus obtained are then condensed with cyclic hydrocarbons, with metallic aluminum as catalyzer in the presence of a suitable diluent (kerosene). The mono- and di-chlor paraffins, when condensed with benzol, tolual or naphthalene, give wax-like hydrocarbons with a drop-point of about 85 deg. F. On the other hand tri-chlor paraffin, with the same aromatics, gives clear viscous oils having lubricating qualities of high degree, with flat temperature-viscosity curves. The yields with aluminum catalyzer are good, 70 to 80 percent. The other 20 percent is a heavy black resin containing organic compounds of aluminum, which may be used as catalyzer in the next condensation. The color of the end products depends very much on the completeness of separation of the complex resin compounds.

## Petroleum Physics

**Physical and Chemical Properties of Petroleum Fractions.**—Harry T. Rall and Harold M. Smith, in IND. ENG. CHEM., anal. edit., vol. 8 (1936), No. 5, pp. 324–330.

A knowledge of the real or apparent molecular weights of petroleum products is of importance in fractionating operations. In this paper a modified Beckmann apparatus and method for the cryoscopic determination of molecular weight are described. Results obtained with this apparatus, using benzene as the solvent, are given for oils having molecular weights of approximately 200, 300, 500, and 700.

Comparative cryoscopic data from eleven cooperating laboratories for the same oils in benzene solution are given and discussed.

Data are presented showing that impurities (aside from moisture) and moisture exert adverse effects on molecular weight determinations. The presence of impurities probably at least partly explains the discrepancies universally found in cryoscopic determinations of the molecular weights of oils. It is therefore advisable to use the purest available solvent and to determine its constant with a known pure solute.

**Composition and Conductivity of Oils and Waxes.**—Andrew Gemant, in JOUR. INST. PETROL. TECH., vol. 22 (1936), No. 155, pp. 646–662.

The conductivity-temperature curve of oils and waxes in the melting region allows certain conclusions to be reached as to their composition. For this purpose, a theory is put forward that such systems consist of two phases: a crystalline and a glassy or amorphous one, both having their characteristic conductivities and determining the total conductivity by their volume-ratio. This assumption accounts for the characteristic shape of the curve possessing a pronounced maximum. At the same time the distribution curve of the individual components among the different melting points in the mixture can be deduced. The rigorous construction of the chemical composition would require the knowledge of other physicochemical data, especially of the equation for the depression of freezing point for concentrated solutions, in absence of which only an approximate computation is possible. In addition, the theory explains the observed dielectric absorption of oils in the transition region.

The theory is developed quantitatively, and three examples of numerical calculation on experimental data are given. These data refer to a lubricating oil, a cable oil and paraffin wax.

**Hydrocarbon Mixtures and Variations of Their Physical Characteristics.**—Eugene Prevost, in REV. COMBUSTIBLES LIQUIDES, vol. 14 (1936), No. 138, pp. 263–271.

The physical characteristics of a mixture of hydrocarbons are, in general, not the algebraic resultants of the characteristics of the components. However, in the case of products of the same or closely related families possessing similar general properties, it is always possible to determine, *a priori*, the principal properties of a mixture with a close approach to accuracy.

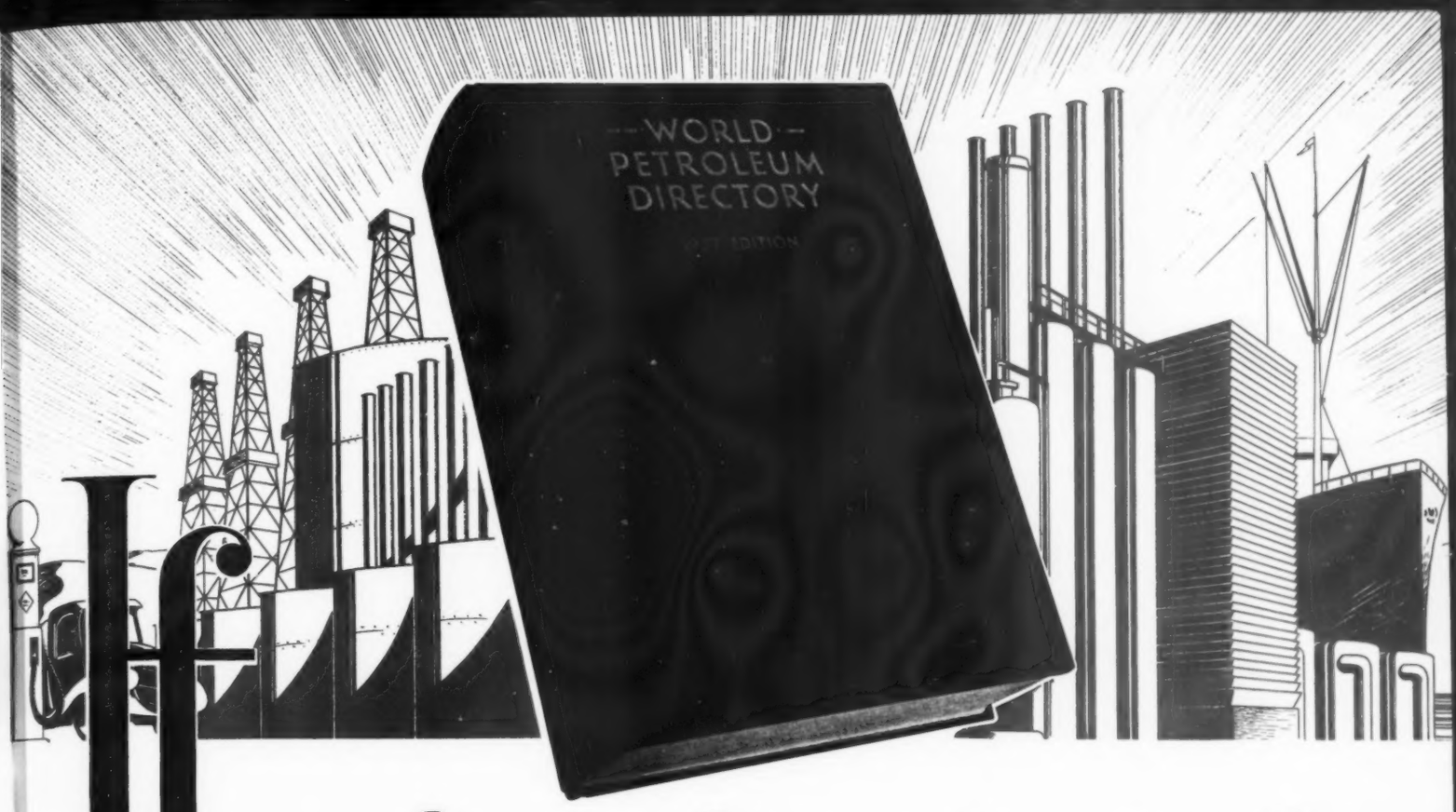
That is to say, every hydrocarbon which gives a normal response to the usual tests for viscosity, distillation, flash point, etc., is to be regarded as a normal hydrocarbon that will carry these properties unchanged into a mixture with other hydrocarbons of the same class. On the other hand, every mixture of products of diverse characters will result in a product whose characters cannot be predicted by any simple rule, and such mixtures should be avoided.

**Analytical Fractionation of Hydrocarbon Gases.**—Wallace A. McMillan, in JOUR. INST. PETROL. TECH., vol. 22 (1936), No. 155, pp. 616–645.

Results of five years' work on the testing and proof of the absolute accuracy of methods and apparatus for the analytical fractionation of hydrocarbon gases by the use of synthetic gas mixture of known composition is presented. From the data and discussion included, it is apparent that reproducible results accurate to 0.1 percent can be attained only through rigid standardization of apparatus and methods. A complete discussion of dead space errors, column packings, heaters, condenser sections and thermocouples, together with the operating effects of reflux ratios, rates, sample sizes and methods of calculations, is given, and changes are outlined to obtain the accuracy and reproducibility required.

**Constitution and Viscosity of Liquids.**—G. Hugel, in REV. PETROL., No. 710 (1936), p. 1715.

The author raises the question of why polycyclic aromatic hydrocarbons have a very

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poor viscosity curve while the curve of the paraffin hydrocarbons is an excellent one. The explanation seems to be that the molecules of the former class tend to become "associated" at low temperatures, whereas the introduction of aliphatic side chains into their molecules tends to break up such associations. For this reason it may be supposed that, conversely, when the temperature of a polycyclic aromatic hydrocarbon is raised there is a breaking up of certain molecular complexes. There is even evidence that huge molecular aggregations in liquids may be broken up by mechanical means. An experiment is described in which solutions of polyprane in lubricating oils were forced through a No. 3 Schott porous filter under a pressure of 150 atmospheres. Under these circumstances the oil which passed the filter had a notably decreased viscosity.

X-RAY DIFFRACTION STUDIES OF LUBRICANTS.—Geo. L. Clark, Robert R. Sterrett and Bert H. Lincoln, in IND. ENG. CHEM., vol. 28 (1936), No. 11, pp. 1318–1328.

The authors applied X-ray diffraction analysis to a study of various substances that when added to lubricating oils enhance film strengths on metal surfaces and improve the performance of the lubricants. Chlorinated esters of long-chain acid and short chain-alcohol types are found markedly superior to the unchlorinated esters in the orientation and doubling of the lubricating layer, which accounts for the increased film strength of oil blends containing these added ingredients. The X-ray diffraction analysis method affords a good way to evaluate the effects of such additions.

## Uses of Petroleum

SIGNIFICANCE OF DIESEL FUEL KNOCK RATINGS.—Joseph Liston, in REFINER, vol. 15 (1936), No. 10, pp. 401–406.

Until recently there has been a popular notion that any kind of oil that would flow through a pipe could be burned in a Diesel engine; this was doubtless true of the former slow speed air and solid injection units. But the recent trend toward higher speeds and increased specific output have changed the situation so that heavy crude and highly cracked fuels are no longer entirely satisfactory and it is now apparent that Diesel fuels must be prepared to meet more exacting specifications. Roughness and knocking in many of the new highspeed Diesel engines are due in large part to a too long delay between the time when the fuel begins to enter the combustion chamber and the time when it begins to burn. If this delay can be shortened less knocking and smoother operation should result. The attack on this problem may be generally divided into two directions, first, changes in the mechanical design of the engine, and second, alteration of the combustion characteristics of the fuel. Among outstanding facts relating to design is evidence showing that increasing the compression ratio in the Diesel engine tends to decrease knocking (the reverse is the case with the gasoline engine). As regards reduction of Diesel knock by controlling the combustion characteristics of the Diesel fuel it seems that the most likely approach is through comparisons with a reference fuel, such as the cetane-alphamethylnaphthalene standard, analogously to the octane standard that is applied to gasoline. However, there are differences to be borne in mind. In the case of gasoline it is the unsaturated hydrocarbons that have high resistance to detonation; saturated straight chain hydrocarbons give the poorest results in gasoline engines. With the Diesel engine the case again seems to be reversed; the research results to date appear to indicate that for Diesel fuels it is the saturated straight chain hydrocarbons that have the good qualities and the unsaturated hydrocarbons the poor qualities. Whether or not cetane number will become of as much importance for Diesel fuels as octane number is for gasolines is uncertain, but the majority of manufacturers of high and medium speed Diesels are insisting on "ignition quality" in fuel specifications for their engines.

COMBUSTION QUALITIES OF DIESEL FUEL.—G. .D. Boerlage and J. J. Broeze, in IND. ENG. CHEM., vol. 28 (1936), No. 10, pp. 1229–1234.

This is a report of an investigation conducted by the research department of the Bataafsche Petroleum Mij.

Volatility is considered in general and more particularly for fuel deposits. With heavy fuels the physical part of the ignition period is often important.

Viscosity influences the character of the spray and therefore the distribution and the amount of fuel deposited on walls.

Ignition quality is the main factor during the ignition period; at the end of this period temperatures jump from 600–800 deg. to 1,500–2,300 deg. C., which influences distribution via the resulting evaporation.

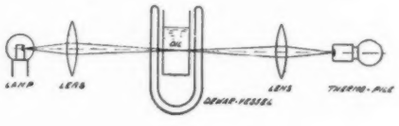
The ignition period consists of a physical and a chemical delay. The former becomes important with heavy fuels, the latter is normally predominant. After-burning is mainly due to uneven distribution and to slow evaporation of fuel deposits on combustion chamber walls; the most favorable mixing conditions are, at best, a compromise between these two. The fuel influences the mixing process by its viscosity, its volatility, and its ignition quality; the optimum value of each property varies with the engine type. A better criterion for volatility is needed. Combustion in C. I. engines is mostly of the destructive type; under certain conditions there is evidence that it may be partially an oxidation process—for example, according to the hydroxylation theory.

DRYING-OILS FROM CRACKED GASOLINE.—Geo. M. Woods, in PETROL. ENG., vol. 8 (1936), No. 1, pp. 106–108.

While investigating possible new degumming methods for cracked gasoline, it was observed that when the unstable products in such gasoline were oxidized by means of air (oxygen) and heat and the gasoline subsequently distilled from the oxidized gums, the latter had a strong resemblance to linseed oil. This suggested the possibility of obtaining a satisfactory drying oil from cracked gasoline; with this idea in view a cracked gasoline obtained from the raw naphtha distillate of a Mid-Continent vapor-phase cracked gasoline was investigated in the laboratory. When this cracked gasoline was oxidized for six hours in a bomb under compressed air at a pressure of 100 lbs. per sq. in., the distillation residue (six percent) resembled raw linseed oil to a remarkable degree, having a saponification number of 188 and an iodine number of 180; the corresponding constants for commercial raw linseed oil are 190 and 186. This drying oil from cracked gasoline has been used as a thinner in both wood and metal paints and in such uses compares favorably with natural linseed oil, although after a year's exposure the lasting quality of the paint film appears not so good. However, it is believed that production of a satisfactory drying oil from vapor-phase cracked naphtha is a matter of more careful control of the process. The cost of manufacturing the product would probably be small, perhaps four cents a gallon. The present price of linseed oil is now around 45 cents a gallon. The annual consumption of all drying oils (linseed, tung, etc.) is approximately 800,000,000 lbs. with a market value of about $65,000,000. The possible market is, therefore, very broad.

DETERMINATION OF THE CLOUD POINT OF DARK OIL.—W. R. van Wijk, in JOUR. INST. PETROL. TECHNOLOGISTS, vol. 22 (1936), No. 157, pp. 754–760.

There are oils that are so dark that no known method of refining, or only a very radical one that would change the nature of the oil, could render them transparent enough for a turbidity test. It is sometimes of importance to make a cloud test on cheap dark oils, such as Diesel fuels, wherein wax separation might cause difficulties by precluding filtration. The object of this paper is to describe a method whereby the cloud point of the original oil may be determined without any preliminary treatment beyond drying.




In principle the method depends on the measurement of the transmittancy of the oil to infra-red radiation at various temperatures, a dark oil being far more transparent to radiation of one to three microns wave-length than to visible light. If there is any separation in the oil, the medium diminishes in transmittancy owing to its optical inhomogeneity, allowing of conclusions being reached from the course of the transmittancy–temperature curve as to the separated matter in the oil. In this way the separation may be detected not only of, say, paraffin wax crystals, but also of traces of substances left over from refining, of asphaltenes and of other matter.

The general arrangement of the apparatus is indicated in the accompanying sketch. The reproducibility is good.

The author considers the advantage of this method to consist not only in the possibility of indicating separations in dark oils, but also in that of following objectively, and also more or less quantitatively, the entire process of separation as a function of the temperature.

The method has also been successfully applied in other cases for measuring turbidities in oil, for instance for the determination of the demixing curves of unrefined lubricating oil and solvents and for the determination of the aniline point of dark oil.

## Petroleum Economics

**The German Four-Year Plan as Concerns Oil Products.**—M. F., in REV. PETROL. No. 711 (1936), pp. 1739–1740.

The new German four-year plan is designed to make the country independent, in four years, of imported basic materials, or at least as independent as possible. Agriculture is to be intensified, the shortage of meat products will be covered by more extensive fishing and the country will simply do without food products it cannot produce.

This program of 100 percent autarchy includes petroleum products. Germany now covers about 45 percent of her petroleum requirements by domestic production, but it appears that the national petroleum reserves do not exceed 1,200,000 tons, which at the present rate of consumption will be exhausted in three years unless new reserves are discovered. In contemplation of this prospect the government is resolutely confronting the problem of utilizing the only other visible source, namely, coal, of which Germany has enough to last hundreds of years. The possible methods of converting coal into substitute petroleum products are (1) destructive distillation to obtain gas, liquid hydrocarbons and coke; (2) hydrogenation of the carbon in the coke obtained in this process, and (3) direct combustion of powdered coal or carbon in internal combustion motors. There are several variations of these principal methods; coal may be carbonized at high, medium, or low temperatures. These give rise to different proportions of combustible liquid and gaseous products, but they all give coke which can be completely converted into pertoleum products by the Fisher carbon monoxide-hydrogen synthesis, the tar resulting from carbonization can be hydrogenized by the I.G.F. process. Another new process of coal utilization on which great hopes are founded is the Pott and Broche process by which coal can be extracted with solvents to give Diesel fuels. All these expedients are mutually complementary; the one gives light motor fuels, another gas oil, another gasoline and lubricating oils; one process may produce coke to be utilized in another process. It remains to coordinate these several processes so that with a minimum of labor and expense they shall be the means of achieving, in four years, German independence of imported petroleum even though native petroleum deposits be exhausted in the meantime. This is the task of the Gruppe der Kraftstoff-Industrie (Power-Fuel-Industry). In pursuit of this objective the known processes will be put in operation on the largest possible scale, and research on outstanding technical problems will be intensified.

In the view of a detached technician, there does not appear to be any real reason why the Germans should not achieve 100 percent autarchy in four years so far as quantity is concerned, but it may not be possible to obtain a sufficiency of certain qualities, such as special lubricants and aviation fuels.

At the present time alcohol, produced from farm products, figures largely as a substitute motor fuel in Germany. It has been recognized that the capital cost of producing a ton of agricultural alcohol is twice as great as of producing a ton of synthetic gasoline, which is all the more reason for hastening the development of the synthetic petroleum industry so that the land now devoted to alcohol production can be returned to its proper function of contributing to the food resources of this overcrowded nation.

**Motor Vehicle Tax or Gasoline Tax.**—Oskar Tokayer, in PETROL. PRESS SERVICE, vol. 3 (1936), No. 39, pp. 305–307.

In most countries, at one time or another, the suggestion has been made that the tax on motor vehicles should be replaced by a corresponding tax on fuel. At first sight the idea has much to commend it. The motor vehicle tax, or, as it is called in some countries, the road tax, is in theory intended to be applied to the construction and maintenance of the highways. It is, however, a fixed amount in no way related to the extent to which a particular vehicle makes use of the roads. Whether the mileage covered is small or large, the tax remains constant, and can only be avoided by laying up the vehicle. Consequently, in many countries where this tax is very high, numbers of vehicles are regularly withdrawn from service during the winter months. If, on the other hand, this vehicle tax were substituted by a tax on gasoline, the individual road users would contribute to road maintenance only in accordance with their use of the roads, since gasoline consumption is a reasonably accurate standard by which to measure road wear and tear. Heavy gasoline bills reflect longer journeys, higher speeds or greater weight on the roads; lower fuel consumption means lighter vehicles, shorter distances or slower speeds. It is such considerations as these that have given rise, in recent years, to the idea of substituting a road tax by a duty upon gasoline.

This question has apparently been given the most complete study in Holland, where a Commission advised against the change, chiefly on account of fear of loss of revenue. The Commission did not consider whether a partial remission of the vehicle tax or its substitution by a very small addition to the gasoline tax would not be likely to produce such a strong revival of motor traffic as to remove all fear of a deficit. Yet the case of Germany is well worthy of attention. The enormous expansion of German motor traffic since the repeal of the vehicle tax has more than compensated for the loss in revenue by its remission.

## General

**Research Costs and Trends.**—W. C Winning, in WORLD PETROLEUM, vol. 7 (1936). No. 10, pp. 466–467.

It has been estimated by Egloff and Nelson that about $5,000,000 a year is being expended on cracking research; as present production of cracked gasoline is now about 250,000,000 bbl. a year, it is figured that research costs average about two cents a barrel, or about 1¼ percent on the $400,000,000 now invested in cracking equipment. The foregoing relates to cracking research. From data available to the author it is estimated that the petroleum industry as a whole is spending about $21,000,000 on research, which is less than one percent of the industry's total investment of $3,400,000,000. To judge by volume of published research, research is going on most actively in cracking and isomerization, refining, motor fuels and lubrication, with distillation and absorption attracting a good share of attention. When judged by the number of patents on new inventions the most active departments are refining, cracking, hydrogenation and specialties.

In refining, the trend of research is to make the refiner independent of any particular source of crude oil, which is to be obtained largely through cracking, isomerization and polymerization. The introduction of solvent refining has also given the refiner some independence in the manufacture of lubricating oils. Another distinct trend is toward the production of specialties and organic chemicals. A noteworthy feature of petroleum research is the tendency to make all worthwhile developments available to the whole industry through non-discriminatory licenses.

**Synthesis of Cyclopropane.**—H. B. Hass et al., in IND. ENG. CHEM., vol. 28 (1936), No. 10, pp. 1178–1179.

Cyclopropane has been characterized by anesthetists as the safest of anesthetic agents. The processes heretofore employed for its production are expensive, and this has hindered its wide adaption by the medical profession. The authors have worked out a simple two-step synthesis from the propane of natural gas, which consists in chlorinating to produce the 1.3-dichlor-propane, which is then reduced by means of zinc-dust to produce cyclopropane.

## Books

**Petroleum Refinery Engineering.**—by W. L. Nelson. Published 1936 by McGraw-Hill Book Co., New York; 647 pp., 185 illustrations; $6.00.

The present volume, which is one of the Chemical Engineering Series, fills a long felt want for a book and text that would embody a practical discussion of engineering design and processing and the application of the principles of chemical engineering in petroleum refining. As such it should be of value to engineering students; to superintendents, engineers, chemists and foremen who may wish to follow the application of theory to their practical work.

The volume is divided into four parts of which the first is a brief survey of the history and development of refining. The fundamental data relative to the composition of petroleum, the routine laboratory tests used in the evaluation of oil stocks and for the design of equipment, and the physical properties of petroleum and the products that may be possibly obtained are treated in the second part of the book. The principles of chemical engineering as applied to the design of refinery equipment such as hydraulics, combustion, heat and material balances, vaporization and condensation and the theory of cracking with illustrative examples of their application are presented in the third part. This may be considered the most important discussion which will be of special value to the chemical engineering student. The fourth part, which deals with the particular elements of refinery equipment and the various processes, also cost and investment analyses, offers illustrative examples in the application of engineering principles and presents directions for organizing computations that will prove very instructive in the economic appreciation of the various refining processes.

# U. S. S. R.

### Official Figures for Soviet Oil Operations

| 1936 | Crude Production (bbl.) | Daily Average (bbl.) | Runs to Stills (bbl.) | Drilling (feet) |
|---|---|---|---|---|
| January | 16,155,300 | 521,139 | 13,933,000 | 509,950 |
| February | 15,288,700 | 526,955 | 13,055,700 | 516,140 |
| March | 16,344,300 | 527,236 | 14,259,700 | 610,306 |
| April | 15,589,000 | 519,633 | 13,418,300 | 619,420 |
| May | 16,454,200 | 530,781 | 14,356,300 | 621,911 |
| June | 15,955,100 | 531,837 | 14,365,400 | 510,860 |
| July | 16,231,600 | 523,600 | 14,692,300 | 535,646 |
| August | 16,322,000 | 526,581 | 14,650,000 | 560,000 |
| September | 16,002,000 | 533,400 | 14,750,000 | 560,000 |
| October | 16,800,000 | 541,613 | 14,800,000 | 550,000 |
| November | 16,700,000 | 556,667 | 14,800,000 | 550,000 |
| Total 11 months 1936 | 177,842,700 | 530,878 | 157,080,700 | 6,144,233 |
| Total 11 months 1935 | 160,588,100 | 480,779 | 133,255,100 | 4,418,215 |
| Total 1935 | 176,688,100 | 497,713 | 146,705,100 | 4,868,465 |
| Quota 1935 | 212,310,000 | 581,672 | 171,500,000 | 5,214,000 |
| Quota 1936 | 213,500,000 | 584,931 | 175,000,000 | 7,100,000 |

Crude conversion: seven bbl. = one ton.

THE PRELIMINARY figures of the Soviet oil industry for the month of November indicate that the slight improvement in crude production noticeable since October has become steady and plan fulfillment for November amounted to 92.9 percent. The increase in crude production over the corresponding figure for the same 11 months of last year is about 10 percent, but the portion of the plan for 1936 fulfilled during the 11 months past equals 88.9 percent as against 91.6 percent required. Of the daily average crude production from all Soviet oil fields amounting to approximately 531,000 bbl., the largest portion or about 400,000 bbl. per day is being derived from Baku.

At Baku plan fulfillment during November amounted between 96 and 99 percent of which the oil field groups of Lenin and Stalin operated above 100 percent with excesses of from 6 to 10 percent on individual days. The other four Baku oil field groups operated below plan as follows: Asisbekov fields 98 to 102 percent, Kaganovitch fields 91 to 100 percent, Kergez 89–101 percent and Ordzonikidze fields 80 to 91 percent.

### Percent Plan Fulfillment

| | |
|---|---|
| Baku | 96–99 |
| Grozni | 88–93 |
| Maikop | 61–79 |
| Bashkir | 72–83 |
| Emba | 58–73 |
| Sakhalin | 85–101 |
| Turcoman | 31–60 |
| Kalinin | 89–109 |
| Voroshilov | 73 |

The first Stakhanov twenty day period of operation initiated by Baku on October 15th and followed by almost all other Soviet oil fields at about the same time has been completed with results much below expectation, but on November 20th a Stakhanov month of operation has been introduced at Baku under which the pledges made carry a general speeding up of operations, particularly in drilling and production in order to exceed the original plan. Crude production during this period is to be increased to 432,000 bbl. per day for all Baku oil fields and the total number of wells in operation will be brought up to 5,408. Drilling distance per day will amount to 17,250 feet at an average speed of 2,112 ft. per month, per table. Not less than 100 new wells will be drilled, completed and brought under production during this period.

S. Slutzki, head of Baku has come to Moscow to discuss this matter with Ordzonikidze and to have him approve of this new Stakhanov move under the assurance that the present pledges will be better fulfilled than those of the Stakhanov twenty day period.

Commenting on oil well operations at Baku an editorial of NEFTENOYE KHOZAISTVO states: The oil operators have first of all to change their attitude toward the operation of oil wells. It is absolutely necessary to take all possible deposits from each oil well, because the ultimate aim is to increase crude production by all means and in the light of the recent order of the Commissar from Soviet Heavy Industries to produce all the oil available it is necessary to analyze each individual region and each individual well with a view to recovering all potentialities at hand. Alongside of the mastering of deep and super deep drilling into the lower formations of the productive strata no opportunity should be overlooked to obtain additional production from wells in operation and particularly from wells which are idle.

At present, the editorial continues, the number of idle and shut down wells is exceedingly high and this is due to the excessive rate of breakdowns with all unproductive stoppages running high. It is not wise to try to increase crude production only at the expense of new drilling in new regions, while many old wells in the old oil fields are being neglected entirely. From the following figures of well operation at Baku during June and July 1936 it is evident that the efficiency factor or well utilization amounts to 63 percent of the wells in operation:—

| | June 1, 1936 | July 1, 1936 |
|---|---|---|
| Wells in operation | 4,526 | 4,539 |
| Wells being repaired | 243 | 236 |
| Idle wells | 2,346 | 2,428 |
| Total wells | 7,115 | 7,203 |
| Rate of wells operated to total | .063 | |

A survey of well operation in the individual oil field groups shows that some of the fields have more idle wells than wells in operation and this is the cause of failure to fulfill the plan.

On January 1st, 1936 a total of 2,730 wells at Baku were registered as idle wells. This number was decreased to 2,664 on July 1st, 1936 which shows that 11 wells were brought under operation during each month. Under a conservative estimate of about 30–35 bbl. of crude production per day at each well, only half of the number of idle wells of Baku would undoubtedly increase the daily average of crude production by about 45,000 bbl. per day as steady flow.

THE unfortunate part of the Soviet oil industry lies mostly in the fact that the general technique of production has progressed very little during the last ten or twelve years. The basic principles of operation have remained, practically, unchanged since 1923–1924 when the Soviets undertook the first reconstruction of oil field operations. This is evidenced alone by the use of Parker type pumps which are used at all sorts of wells with the result that the pump is too costly in operation of normal wells and too ineffective for deep wells. Similar shortcomings are to be found in the use of many more types of equipment, besides pumps. The Soviet oil industry of today lacks flexibility of operation or ability to maneuvre under a variety of conditions. This fact has been clearly stated by S. Ordzonikidze on many occasions. At any rate the Soviet oil industry is not only in arrears against the plan, but it is slow in overcoming obstacles. Having stabilized crude production during the past three years it has created a handicap to progress in all Soviet National Economy. While Soviet Heavy Industries have advanced rapidly between 1924 and 1936, the oil industry has gained little to help this advance.

### Growth of Soviet Industrial Output Between 1924 and 1936

| | 1924 | 1935 |
|---|---|---|
| Output Electr. Power (000,000,000 omitted) | 1.6 | 32.0 |
| Coal Production (000,000 omitted) | 16.1 | 135.0 |
| Pig iron Production " | 0.8 | 14.5 |
| Steel Production " | 1.1 | 16.0 |
| Output Rolling mills " | 0.8 | 12.2 |
| Motor Cars (15 HP. Units) | 20 | 161,500 |
| Output Tractors (Units) | 33 | 154,300 |
| Combines | none | 61,000 |
| Crude oil Production (1931) | 156,300,000 | 176,688,000 |

From a country dependent upon imports Soviet Russia has now become an exporter of many products of her basic industries.

Many new plants were erected and new industries created and a number of old plants were reconstructed.

In the face of such enormous growth in industrialization of the country it is very unfortunate that the oil industry, handicapped itself, is also hampering the progress of Soviet National Economy.

*Here is shown the colorful Colonel Ed. Walters conducting one of the Osage sales under the famous "million dollar oak" at Pawhuska, Oklahoma. The first of these sales took place November 11, 1912 and paid the tribe $39,436. In the twenty-five years since, their income from these sales is estimated totaling $113,752,000.00.*

**"Going—going—gone!" as uttered by Colonel Ed. Walters, famed auctioneer of oil rights, spelled huge wealth for the great Osage Tribe. But, the "going—going—gone" of a dying oil well is another story. DOWELL, through sound methods of Acidizing is prolonging production for thousands of producers—pouring a combined wealth totaling millions into their pockets.**

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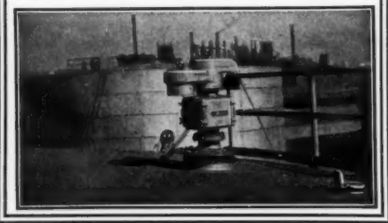


During the past three years Soviet oil reserves have been considerably augmented by proving 15 new oil regions in Azerbaidzan, North Caucasus, Urals, Volga and Centralasia. These new oil fields are bound to make many industrial regions of the country independent of oil supplies from the Caucasus. According to plans for 1937 these new oil fields are to produce 28,000,000 bbl. of crude during the year. Emba and Bashkiria together have produced during the first nine months of 1936 a total of 7,455,000 bbl. of crude as compared with 2,640,000 bbl. produced during the corresponding period last year and are expected to produce 16,100,000 bbl. of crude in 1937. Isimbayevo (Bashkirneft) has grown into a large oil field with a topping plant in the field and a refinery at Ufa to run to stills all Ishimbayevo crude. Emba oil is now being carried by the Gaspi-Orsk pipe line to Orsk for refining. In the Urals along the Kama river the new oil fields of Krasnokamsk are being developed and oil deposits of commercial value have been discovered at Sizran where the oil layers are situated in the Middle Carbon, which has never before been exploited.

Considerable progress has been made in Soviet drilling and drilling speed. At Maikop the drilling speed per table month has increased from 740 ft. to 2,880 ft. between August 1935 and 1936. The speed of production drilling increased from 1,600 ft. to 6,200 ft. during the same time. At Grozni the speed of prospecting drilling has increased from 550 ft. to 1,425 ft. and production drilling speed grew from 1,350 to 3,485 ft. within the same period between August 1935 and 1936. New refineries and new cracking installations have increased the range of Soviet run to stills about 25,000,000 bbl. of crude during the past 11 months as compared with last year and output of straight run gasoline has increased from about 2,500,000 tons during the first 11 months 1935 to about 3,600,000 tons during 11 months 1936. During 1936 six new refineries and 13 new cracking installations have been put on stream.

However, prospecting, development and crude production are proceeding slowly and the number of idle wells is decidedly too high. The country needs more oil, which is not forthcoming and exports have been decreasing since 1932.

### Sizran Oil Development

From Sizran to Stvropol over Samarski Luki stretches a vast territory which promises to become an important oil field. The Sizran and Krasnokamsk findings are indicative of oil all over the western incline of the Urals. The productive depth is situated at about 2,000 ft. So far test wells drilled at Krasnokamsk show greater production than those of Sizran where the wells produce on the average from seven to ten barrels of crude per day. At any rate more efficient operation is required for immediate development and Vostokneft is lacking this as well as equipment and supplies. The Upper Sergiinski works have already shipped to these fields drilling bits of low quality and this hampers progress.

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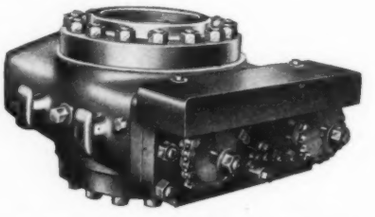

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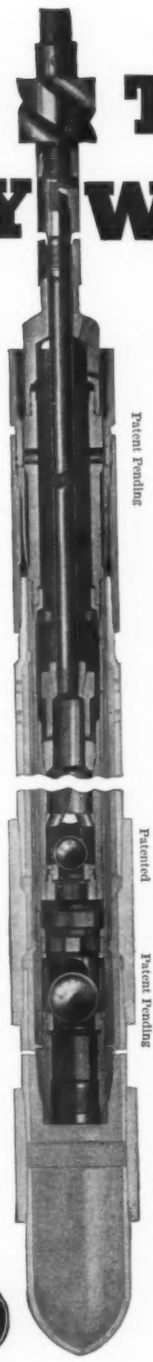
# HANG THIS PUMP IN SANDY WELLS

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The guide type paraffin scraper coupling at the extreme top end of the pump should always be used above every Axelson Pump. It acts as a guide, centralizing the plunger and eliminating the bending or flexing of the pump rod.

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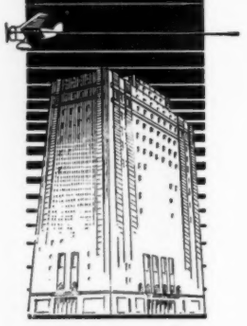

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came in in this region of Daghestan on the Caspian sea. This property was prospected and contoured and has been placed under immediate development. S. Ordzonikidze, Commissar for Soviet Heavy Industries has ordered that the Daghestan properties including Izberbash shall produce in 1937 not less than 7,000,000 bbl. of crude. Up to the present the development has proceeded slowly owing to lack of electrical equipment and supplies or to defective operation of motors at hand. All drilling of new wells has been slow and the productive sands have not yet been reached. The productive layer is about 6,000 ft. deep and drilling to 5,000 ft. has revealed a show of oil. Well No. 8 which early in the year came in as a producer stopped flowing 14 days after discovery owing to a cave in followed by water which has evidently come from upper ground.

### Caspiorsk

The pipe line between Guryev and Orsk, a 12 inch line with four intermediate pumping stations has already been operating for a year carrying Emba crude to Orsk for refining. The line leads over the vast Kazakstan steppe and has opened the flow of oil from several new oil fields as well as from old fields at Emba. The trunk line between Guryev and Orsk is 710 kilometers and there are some additional gathering lines from Koschagil and Iskin amounting to 136 kilometers. Alongside the pipe line a water main was laid from Iskin over Dossor to Makat over a distance of 61 kilometers.

The line has a capacity of 500,000 tons of crude per year and in view of the fact that Emba crude is of a light grade the line could possibly carry some 900,000 tons of crude per year. Operations at Emba oil fields have proceeded at slow tempo during practically all 1936 with plan fulfillment for crude production between 30 and 55 percent; consequently the Caspiorsk pipe line is operating much below total capacity.

### Soviet Oil Exports

(Jan.–Sept.)

| | 9 Mos. 1936 | 9 Mos. 1935 |
|---|---|---|
| Crude | 274 | 98,272 |
| Gasoline | 321,996 | 487,485 |
| Kerosene | 300,344 | 305,370 |
| Lube Oil | 208,339 | 194,481 |
| Diesel Oil | 45,133 | 74,021 |
| Gas Oil | 399,266 | 381,107 |
| Fuel Oil | 661,852 | 836,795 |
| Others | 10,103 | 18,873 |
| Total | 1,947,307 | 2,396,414 |
| Value in Gold Rbl. | 25,740,000 | 29,980,000 |
| Decrease: Quantity | —18.8 Percent | |
| Value | —14.2 Percent | |

### Export By Countries

| | | |
|---|---|---|
| France | 309,505 | 282,990 |
| Germany | 228,595 | 349,341 |
| England | 214,889 | 213,300 |
| Sweden | 101,880 | 151,110 |
| Belgium–Luxemburg | 97,106 | 83,137 |
| Italy | 82,484 | 170,191 |
| Spain | 64,747 | 151,110 |
| Denmark | 60,387 | 76,013 |
| Other Major Countries | 187,869 | 251,281 |
| All Other | 399,845 | 667,941 |

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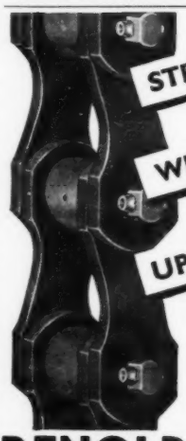

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